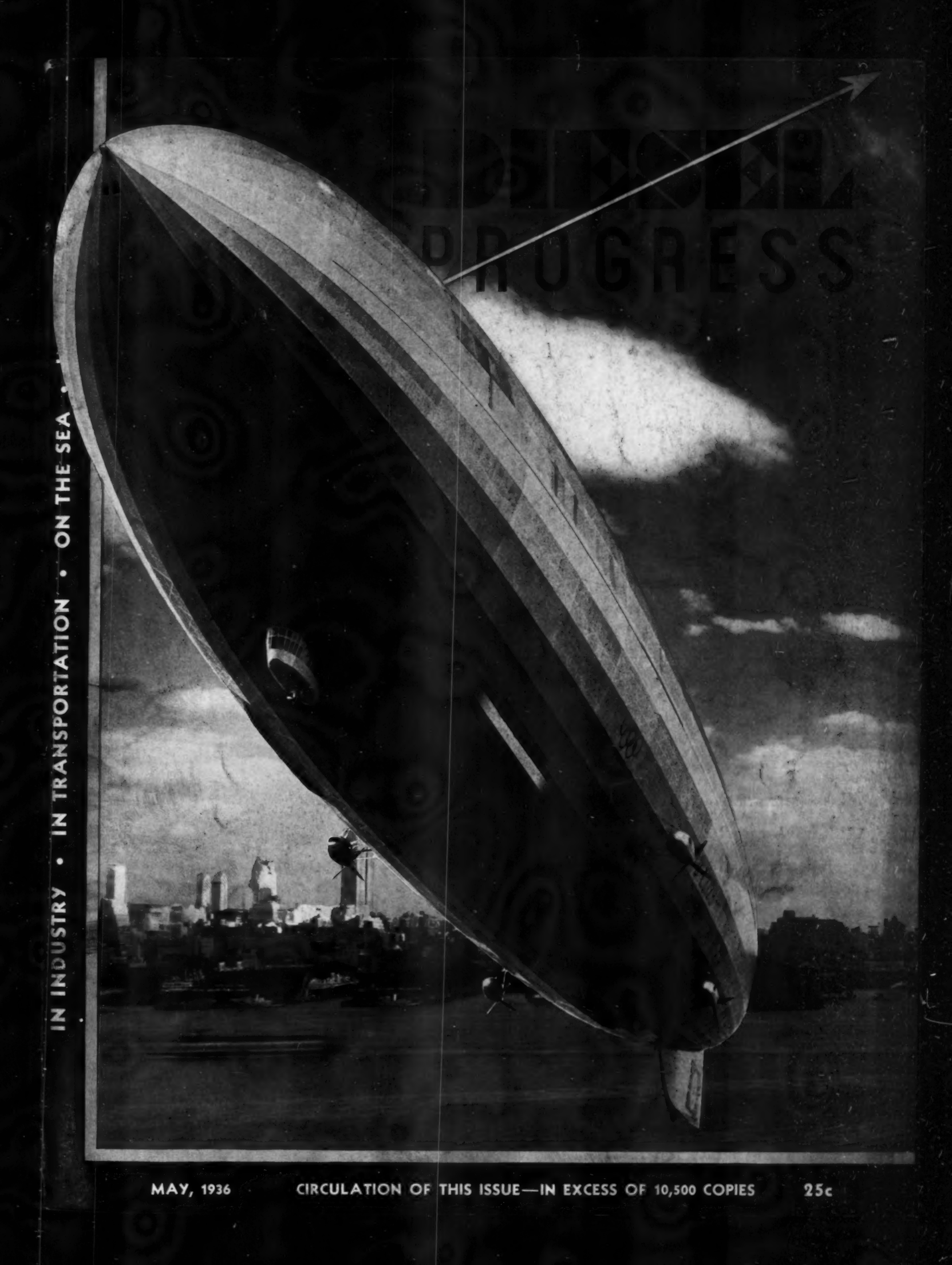


MAY, 1936 CIRCULATION OF THIS ISSUE—IN EXCESS OF 10,500 COPIES 25c

ON TODAY'S LARGEST RAILROAD PROJECT IN U. S. –

GULF QUALITY LUBRICANTS SPEED THE WORK

The country's largest railroad construction job today is 38 miles in length and will connect the towns of Grundy and Jewell, Va. Gulf fuel and lubricants keep this equipment in continuous operation as it carves out a road bed from the sides of the mountains.

"Bulldozers" like this one stand up better in severe service when the right Gulf lubricants protect all moving parts.

Use of the right Gulf Lubricants keeps all Diesel Equipment in continuous operation

With minimum maintenance expense

KEEP YARDAGE MOVING! That is the command on big projects like this one.

And the men who are charged with the responsibility of keeping Diesel Equipment at top notch efficiency take no chances with lubrication. They use Gulf quality lubricants—the oils that every important Diesel builder in the country has tested and approved.

If friction and wear cause shutdowns, time out for repairs and high maintenance costs for your equipment, ask a Gulf engineer if your lubrication is right. It's more than likely that he can give you helpful suggestions.

GULF OIL CORPORATION
of Pennsylvania
GULF REFINING COMPANY
General Offices, Gulf Bldg., Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

Makers of that Good Gulf Gasoline and Gulflube Motor Oil

DIESEL PROGRESS for May, 1936. Volume II, No. 5. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Pan American countries $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U.S.A., 50 cents for all other countries.

Another Nordberg Diesel for Carthage, Missouri

When the new Diesel engine now being built for the municipal power plant of the City of Carthage, Missouri, is installed, four Nordberg Diesels will be in service there. A total of 5500 horsepower will make this one the largest Diesel-engined, city-owned plants in the country.

This engine will have six cylinders, with a bore of 21 inches, stroke 29 inches and at 225 r. p. m. will develop 2250 horsepower. It is of the two cycle type, crosshead construction and arranged for mechanical injection of the fuel.

In this same plant are three more Nordberg two cycle type Diesels. The first unit of 750 horsepower was placed in service in 1921. Then in 1923 and again in 1927 units of 1250 horsepower were installed. All these engines are still in service. Their profitable performance has won nation-wide recognition for the Carthage plant. It stands foremost among the Diesel-engined, municipally owned power plants of the country.

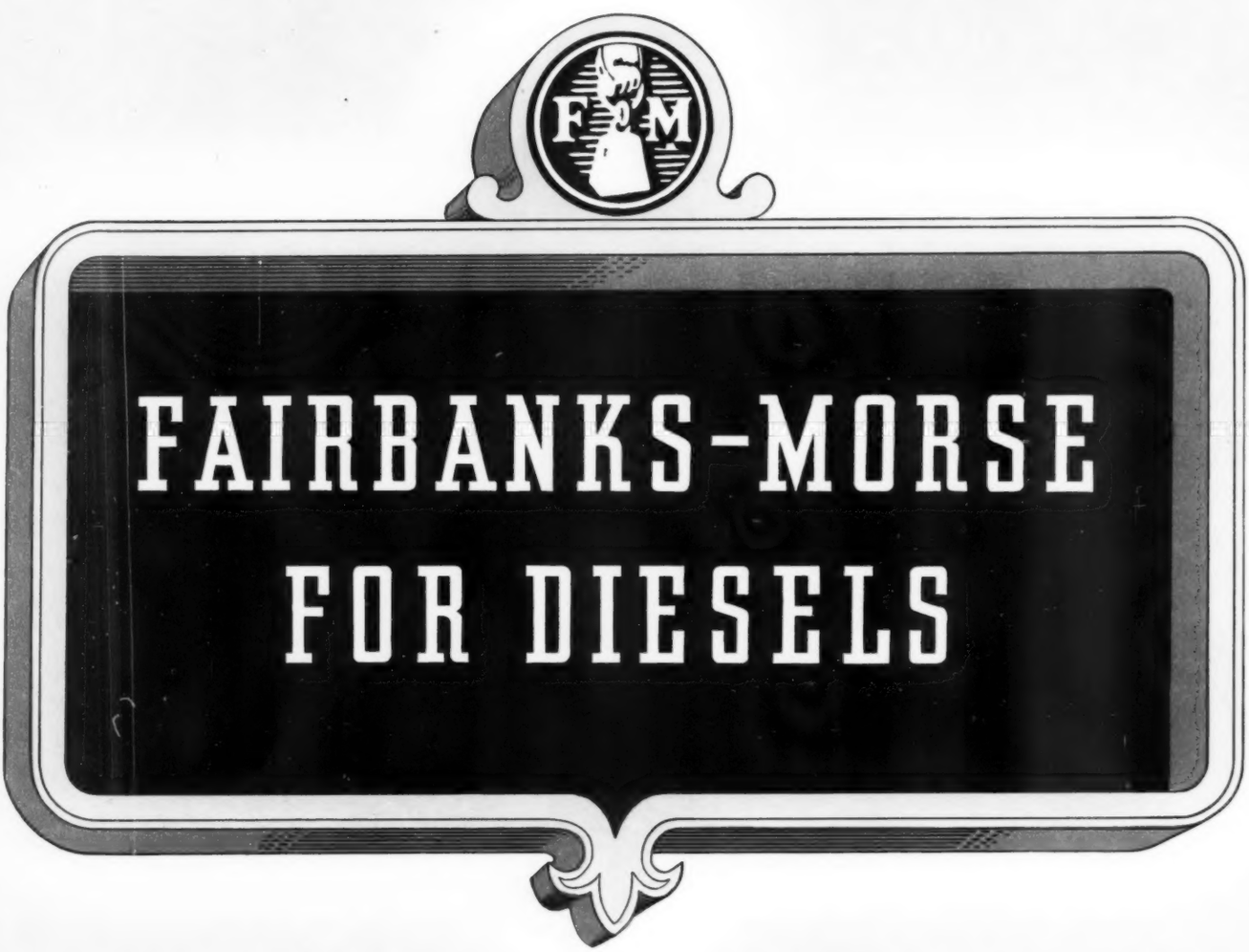
Where there is a need for low cost, dependable power, the extensive line of Nordberg Diesels permits the broadest selection. They may be had in two or four cycle types, crosshead or trunk piston construction and for air or mechanical injection of the fuel. The capacities range upward from 150 horsepower to any size required.

NORDBERG MFG. CO.

MILWAUKEE, WIS.

New York City, 60 E. 42nd St. **Washington, D. C.,** 917 Barr Bldg. **Cleveland, O.,** 318 Rockefeller Bldg.
Kansas City, Mo., 2 W. 62nd St. **Dallas, Tex.,** 3542 Mockingbird Lane **Los Angeles,** Subway Term. Bldg.

Afloat ... or Ashore ...



F-M Marine Diesels range from compact 10-hp. units for workboat propulsion up to engines for the largest freighters. Auxiliaries supply current for battery charging, drive compressors, or bilge pumps.

F-M stationary Diesels have an even wider range. Power units complete and self-contained deliver 10 to 160 hp. Stationary Diesels in the compact "Model 36" type . . . special oil engines, instantly convertible to running with natural gas . . . larger stationary engines for factory and municipal use . . . advanced type opposed piston Diesels.

When you buy, remember the extra advantages that only a manufacturer with his wide range of types and sizes has to offer. Address Department H81, Fairbanks, Morse & Co., 900 South Wabash Avenue, Chicago, Ill. 34 branches at your service throughout the United States.

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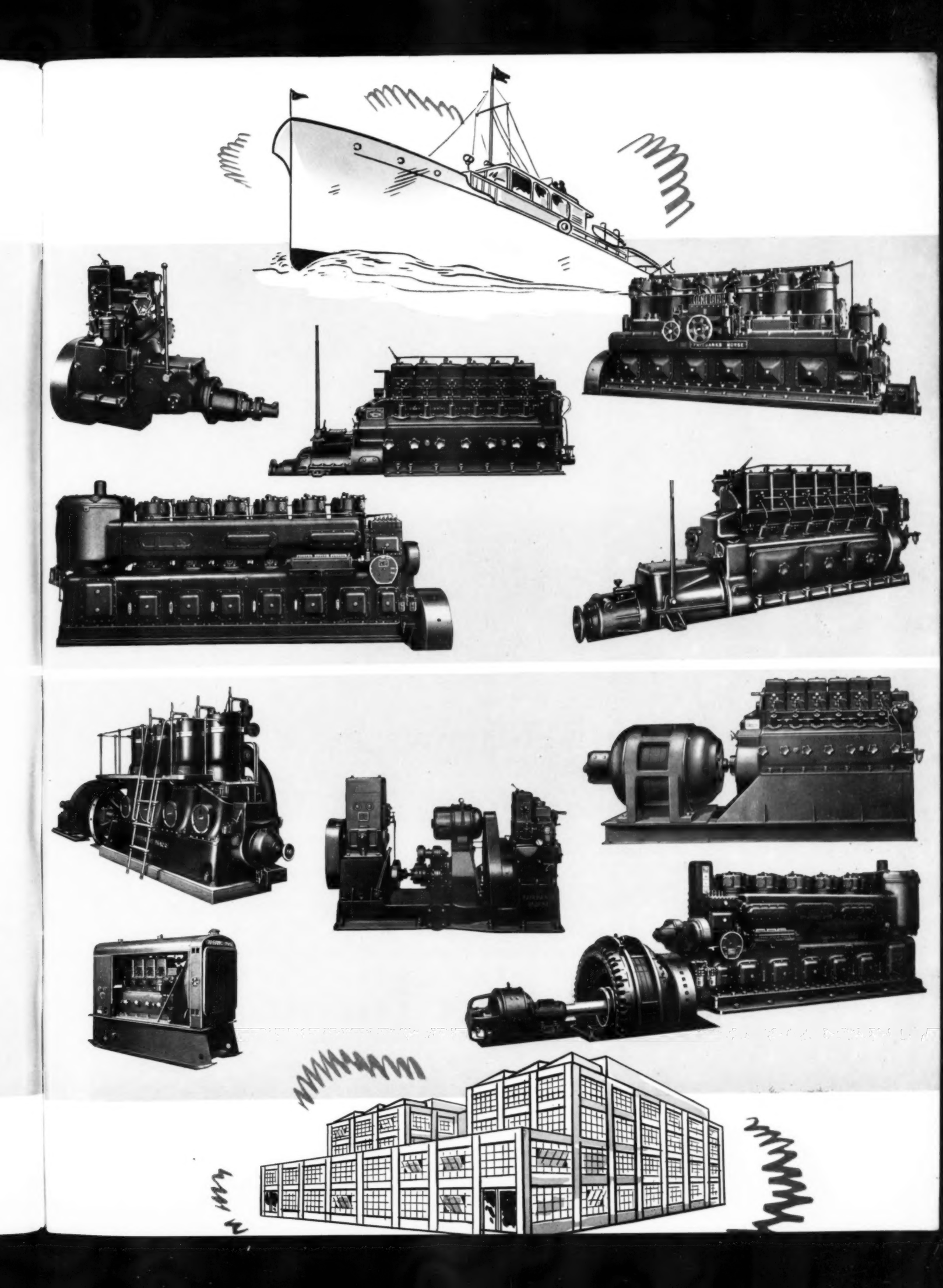
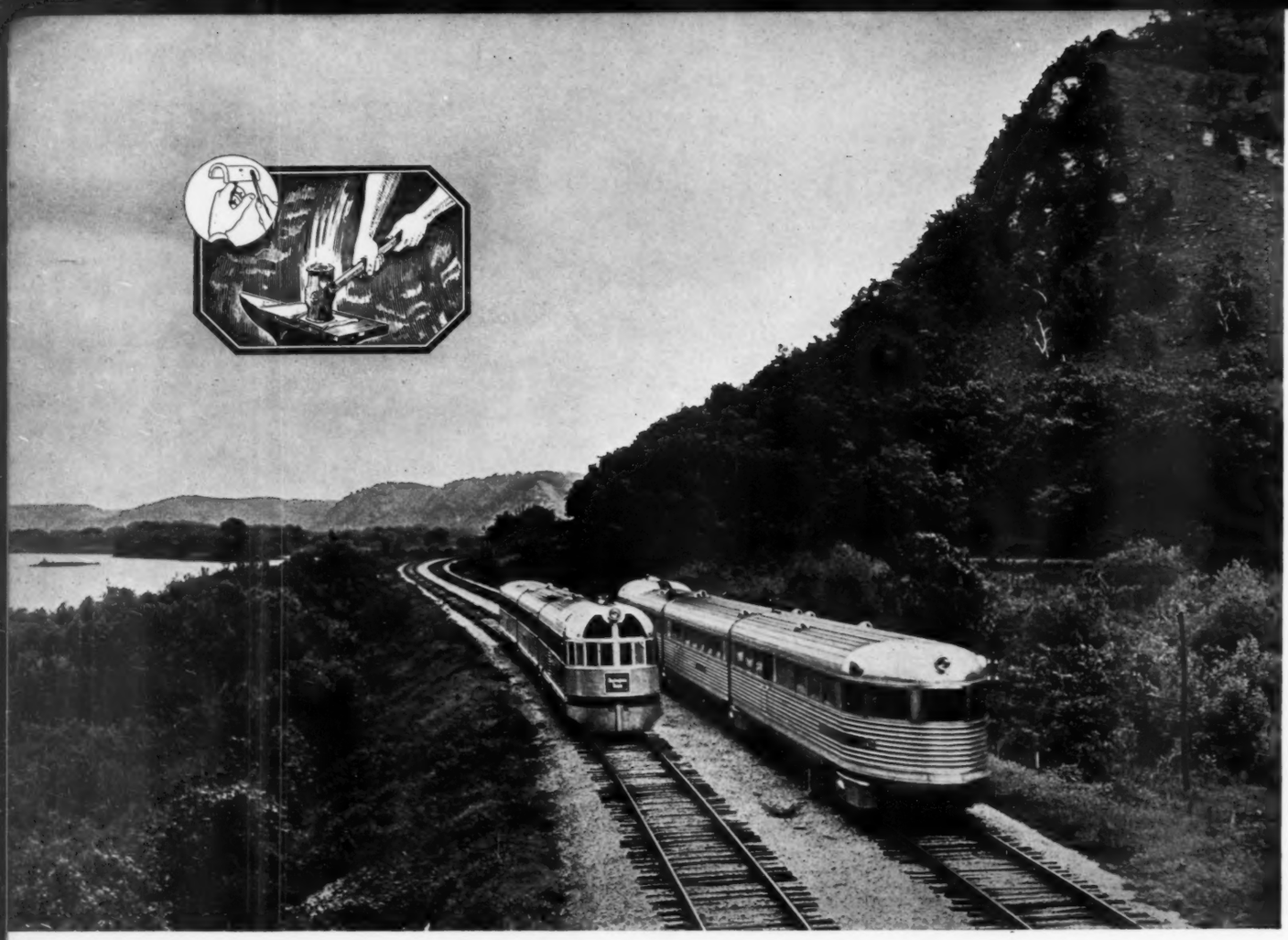




a QUOTE
from a man who knows . . .

"Despite the heavier pressure of a Diesel, as compared with a gasoline engine, we have had absolutely no trouble with the main crankshaft or connecting rod bearings." — F. G. GURLEY,* Burlington Lines.

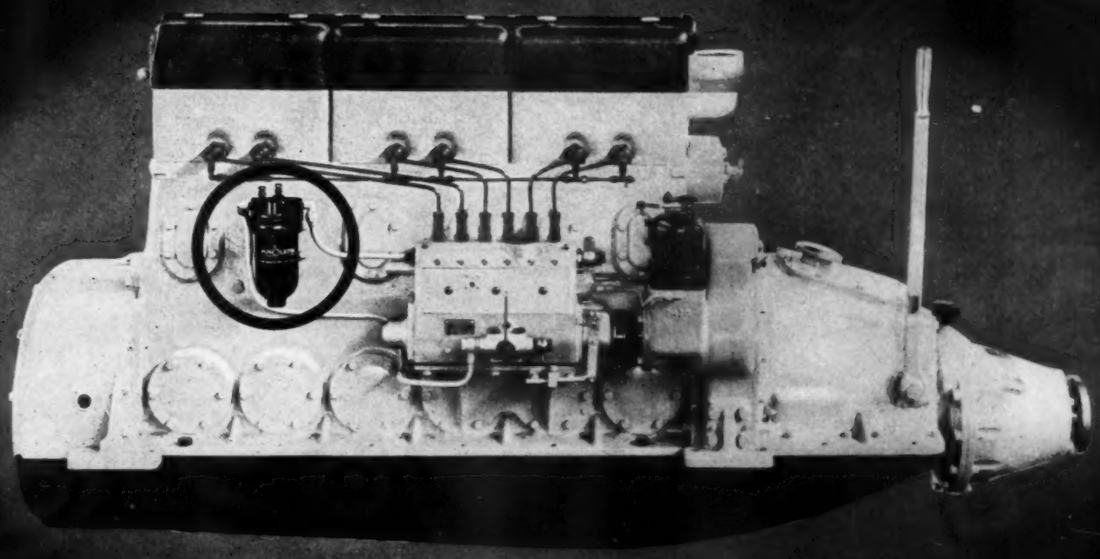
This is a meaningful tribute both to Satco metal and to American Bearing Corporation manufacture because the Winton Diesel engines in the four Burlington "Zephyrs" now operating are equipped with Satco-lined American bearings. And the Winton Diesels now under construction for the new "Zephyrs" will be equipped with Satco-lined American bearings. Nothing succeeds like success . . . our Satco-lined bearings in Diesels of all types have given uniform satisfaction.

Satco metal is a patented alloy manufactured by National Lead Co. Trade mark registered.
*Read Mr. Gurley's article on Page 35.

AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS — CENTRIFUGAL American Bearings FORCE — INDIANA



EVIDENCE

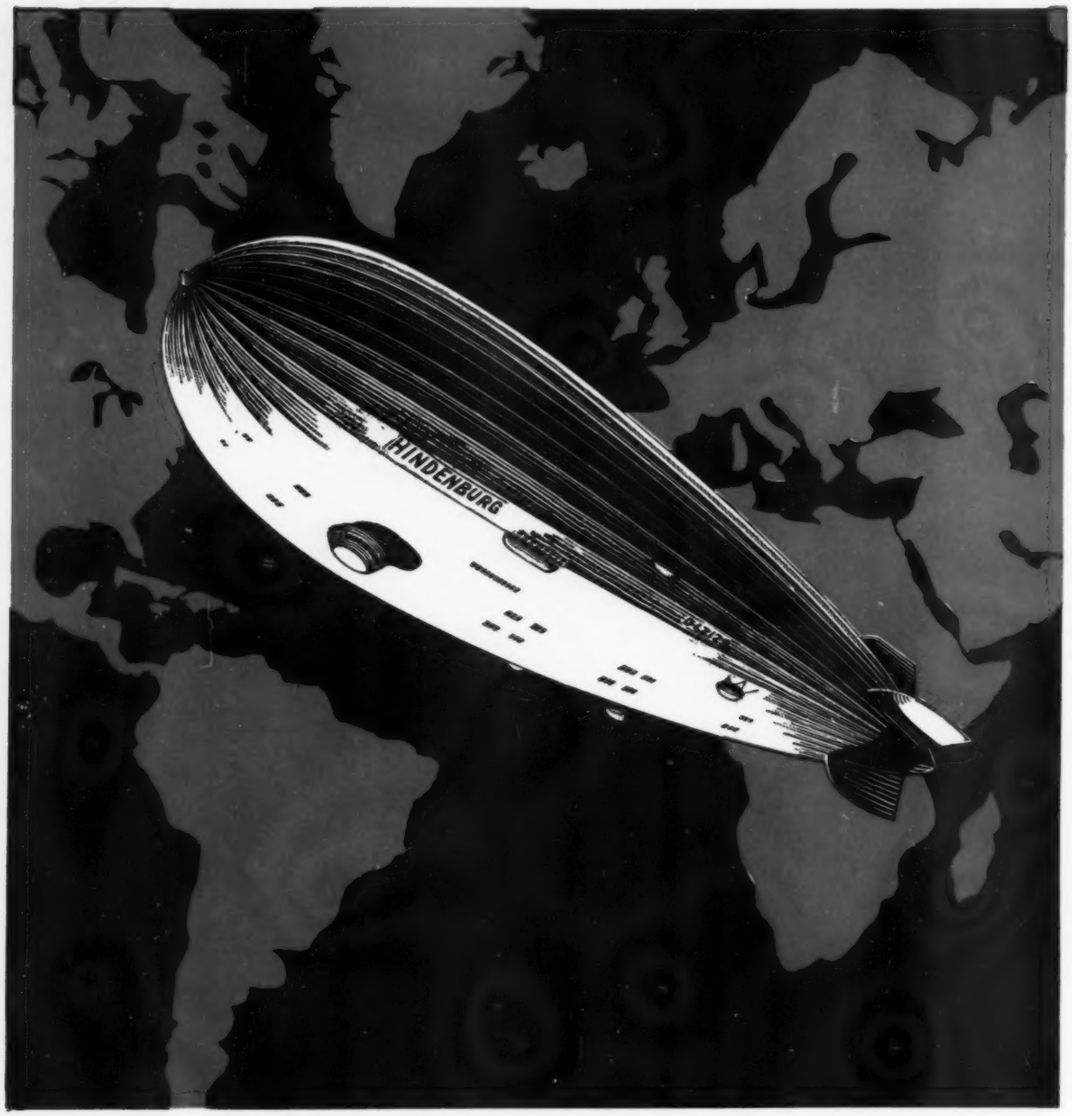
The National-Superior Company's 6-cylinder 100 H. P. Superior Diesel ... fitted with reverse and reduction gears ... has received general acknowledgment as a sturdy, dependable, economical power unit for pleasure craft, and small commercial vessels.

That this good Company has selected the Purolator Oil Filter for the protection of its fuel is further evidence of Purolator's leadership in the Diesel oil filter field. We invite contacts with every character of Diesel power unit, seeking positive, reliable filtration service. Motor Improvements, Inc., Newark, New Jersey, makers of

PUROLATOR

The Oil Filter

THE HINDENBURG . . .



INDUSTRIAL
TYCOL
OILS-GREASES

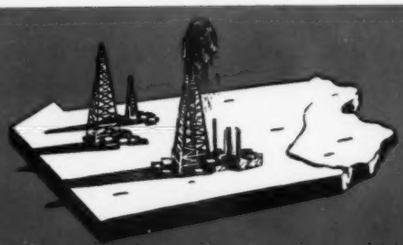
TIDE WATER

THERE IS A COMPLETE LINE OF TYCOL

The Flying Yankee, Crack Train of the Boston and Maine and Maine Central Railroad, is Lubricated with

VEEDOL

a Product of the Tide Water Oil Company



WORLD'S GREATEST ZEPPELIN

selects TIDE WATER LUBRICANT

THE product of the highest engineering skill, plus four years of the most painstaking effort, has been entrusted to Tide Water. The four 1050 hp. specially designed motors—the first Diesel motors to propel an airship—depend upon a Tide Water lubricant to insure their smooth and unfailing operation. Diesel engines were chosen for safety and economy and for these same reasons Tide Water lubrication was specified.

Proper lubrication is always important...in the air it is vital! For eight years a Tide Water lubricant has protected the engines of that veteran of the air, The Graf Zeppelin. With over 1,000,000 miles of safe and dependable flying behind her, the superiority of that lubricant has been proven beyond doubt.

Tide Water can do the same kind of a job for you. Working with the finest crudes in the world, Tide Water's skilled and experienced engineers produce and apply industrial lubricants which insure safe and economical lubrication.

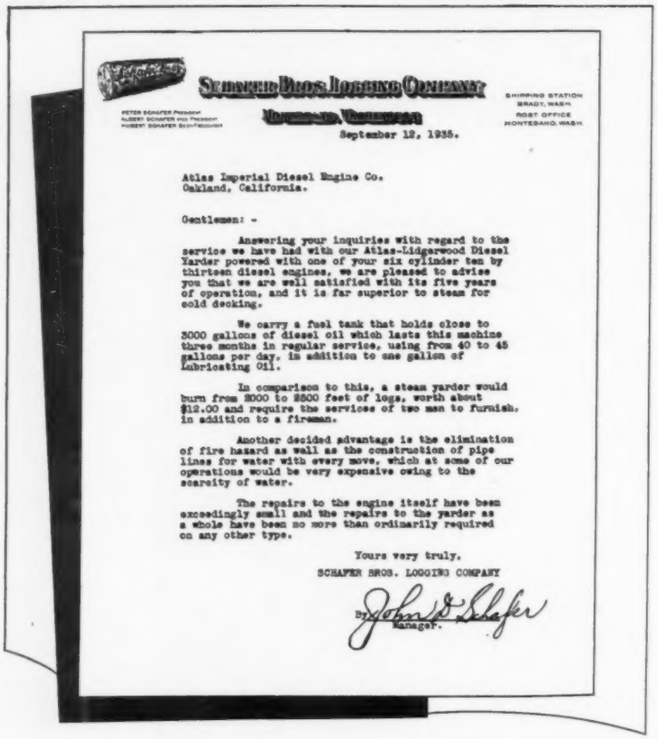
TIDE WATER OIL COMPANY

17 Battery Place, New York, N. Y.

INDUSTRIAL LUBRICANTS

LUBRICANTS SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE

ATLAS DIESEL *power*—"Far *Superior to Steam for Cold Decking!*"



SCHAFER BROS. LOGGING COMPANY

SHIPPING STATION
BRADY, WASH.
POST OFFICE
MONTESANO, WASH.

September 12, 1935.

Atlas Imperial Diesel Engine Co.
Oakland, California.

Gentlemen: -

Answering your inquiries with regard to the service we have had with our Atlas-Lidgerwood Diesel Yarder powered with one of your six cylinder ten by thirteen diesel engines, we are pleased to advise you that we are well satisfied with its five years of operation, and it is far superior to steam for cold decking.

We carry a fuel tank that holds close to 3000 gallons of diesel oil which lasts this machine three months in regular service, using from 40 to 45 gallons per day, in addition to one gallon of Lubricating Oil.

In comparison to this, a steam yarder would burn from 2000 to 2500 feet of logs, worth about $12.00 and require the services of two men to furnish, in addition to a fireman.

Another decided advantage is the elimination of fire hazard as well as the construction of pipe lines for water with every move, which at some of our operations would be very expensive owing to the scarcity of water.

The repairs to the engine itself have been exceedingly small and the repairs to the yarder as a whole have been no more than ordinarily required on any other type.

Yours very truly,
SCHAFER BROS. LOGGING COMPANY
By John D. Schafer
Manager.

WHEN John D. Schafer, one of the outstanding loggers of the Northwest, says that his Atlas Diesel powered Lidgerwood Yarder is "far superior to steam for cold decking" you have the opinion of a man who has had a background of five years' experience on which to base his appraisal. Such a judgment is not prejudiced by the enthusiasm of salesmanship, but reflects cold facts.

In addition to the elimination of the fire hazard and the far greater economy of Diesel power, the Diesel engine is particularly valuable in "long haul" operations. A steam engine can go only as far and as fast as the steam capacity of the boiler will permit. Atlas Diesels therefore show up at their best when taking the "outside swings" — beyond the reach of the steam donkey.

The application of Diesel power to Logging and Lumbering, as well as eight other specific industries, is illustrated and described in our catalog No. 934F. This book treats the business side of Diesel power and is devoid of mechanical details. A request on your business letterhead will bring you a copy of this valuable book.

Every operation of this Atlas Diesel powered Lidgerwood Yarder can be controlled without the operator having to move out of his tracks

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIFORNIA • MATTOON, ILLINOIS

ATLAS IMPERIAL

1936 ★★★★★ TWO CENTS IN THE CITY

Low Rate Modernization Credit Now Available to All

Equipment Acceptance Announces New 5% Financing Plan

FILLS GAP LEFT BY REVISED F. H. A.

Lease Restrictions Overcome — Result Is All Types of New Machinery and Equipment May Now Be Bought on Most Favorable Terms Ever Generally Offered

Check This List!

Here are a few things for which Modernization Credit may be had:—

Diesel Engines
for air compressors
cranes
drilling equipment
grinders
generator sets
hoists
injection pumps
oil field line pumps
refrigerators
water pumps
marine craft
power plants

and many others

Plans for using F. H. A. Terms to buy new machinery and equipment need not be hampered by the recent contraction of F. H. A. Credit. The law as revised April 1st excludes all products costing less than $2,000 and in other ways restricts the list of eligible equipment.

To fill the gap and spread the use of Modernization Credit, C. I. T.'s Equipment Acceptance Corporation announces a 5% Plan of its own to cover the financing of all equipment —whether eligible for F. H. A. or not—at identical low rates.

Orders may now be placed for whatever equipment is needed, without restriction of type, on F. H. A. Terms or the equivalent.

Already hundreds of progressive manufacturers are providing this 5% long term Modernization Credit to their customers, through Equipment Acceptance Financing.

This is an opportunity to bring your plant and equipment into line with any competitor's; to step up operating efficiency, effect important savings—without impairing working capital. Your program may pay its own way from the start out of increased earnings or savings.

News Which Calls for Action!

SEND THIS MEMO TODAY

EQUIPMENT ACCEPTANCE CORPORATION
A UNIT of COMMERCIAL INVESTMENT TRUST CORPORATION
1 Park Avenue, New York City
CAPITAL AND SURPLUS OVER $100,000,000

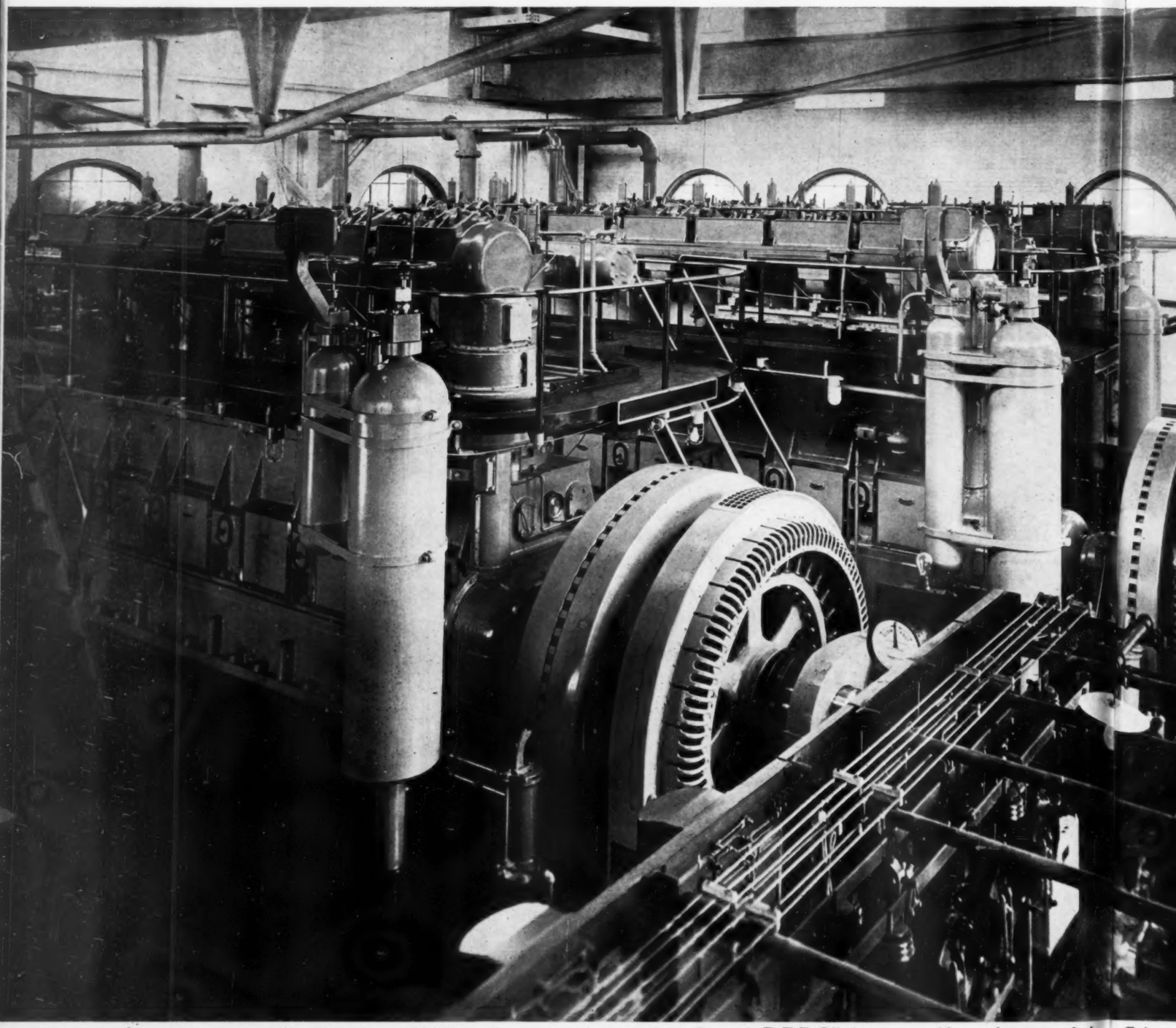
Without obligating myself in any way, I am interested in considering taking advantage of your new 5% Modernization Credit Plan to purchase such equipment as:

DESCRIPTION AND MAKE OF EQUIPMENT	ESTIMATED COST

FIRM NAME _____ REPLY TO _____

ADDRESS _____ D-2

We make GUINEA



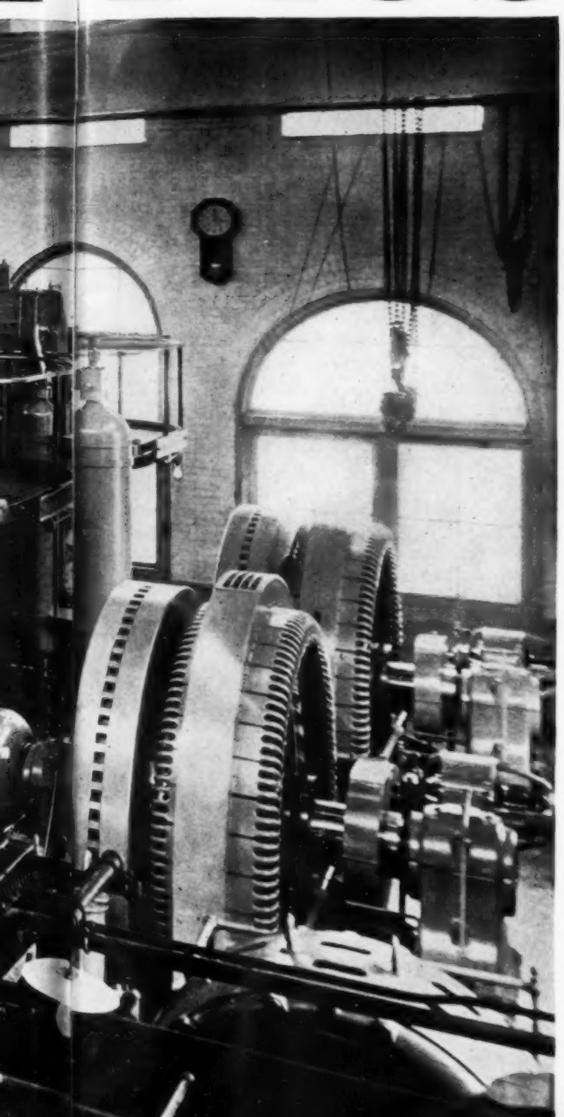
IN BIG UTILITY INSTALLATIONS like this, or in small high-speed units down in the oil field, Gargoyle D.T.E. Oils have proved by performance their efficiency

SOCONY-VACUUM OIL CO.

INCORPORATED

STANDARD OIL OF NEW YORK DIVISION • WHITE STAR DIVISION • LUBRITE DIVISION • WHITE EAGLE DIVISION
WADHAMS OIL COMPANY • MAGNOLIA PETROLEUM COMPANY • GENERAL PETROLEUM CORPORATION OF CALIFORNIA

A PIGS *of our own* DIESELS!



Socony-Vacuum's Diesel Engines – including all leading makes – are constantly used to test Gargoyle D.T.E. Oils. This means valuable extra protection for you!

GETTING THE RIGHT OIL for your Diesels – no matter what the service requirements may be – is no longer a trial-and-error matter. Socony-Vacuum does this testing for you . . . on the type of Diesels you own!

Down in the oil fields, Socony-Vacuum operates all makes . . . all sizes of Diesels. Test after test is made to secure the right oil for each engine.

These tests prove that Gargoyle D.T.E. Oils have fewer carbon-forming elements than other oils. They stay clean longer . . . minimize stuck rings . . . save repairs . . . lower fuel consumption. If they didn't we'd make oils that did!

Ask the Socony-Vacuum representative to tell you about the greater engine efficiency...valuable economies...which operators standardizing on Gargoyle D.T.E. Oils are now getting.

e their efficiency and economy.

GARGOYLE

Lubricants

EXPERIENCE
A VITAL FACTOR

New Illinois Central Diesel

The Latest Contribution to a Long List of Economical I-R Units . . .

THERE is no substitute for experience. In the manufacture of Diesel engines for locomotive service the INGERSOLL-RAND COMPANY enjoys the enviable reputation of pioneer and builder of 115 Diesel Electrics.

This experience is the foundation upon which has been built the reliability, high efficiency and low operating cost of INGERSOLL-RAND Diesels. Performance records of units operating under all kinds of adverse conditions prove the thoroughness of I-R design and construction.

The new 1800-hp. unit just completed for the Illinois Central has already been placed in service and is operating satisfactorily. This Diesel Electric is operating in freight transfer service between Chicago and Markham yard, supplanting two steam locomotives required for the same service.

I-R Diesel locomotives offer tremendous savings. Our long experience is your assurance of correct Diesel application to your railroad problems.

Illustration below shows the latest I-R achievement. This 1800-hp. locomotive is 60 ft. long and weighs 349,000 lb. Maximum tractive effort is estimated at 102,600 lb.

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"ALNOR"

Exhaust Pyrometer Serves U. S. Engineers Diesel Work Boat

"PHILLIPS"

• As in numerous other recently completed U. S. Engineers boats, an "Alnor" Pyrometer was chosen to serve and protect the main Diesel engine in the work boat "Phillips."

The "Phillips" is powered with a Buda Lanova, Model 6LD-MR909 full Diesel, 6-cylinder, 4-cycle, solid-injection 5¼" by 7" engine, developing 127 hp. at 1,000 rpm. It is equipped with an "Alnor" Model RB multi-point Pyrometer to provide exhaust temperature readings of each cylinder.

"Alnor" Pyrometers offer a choice of sizes and styles to suit every size of engine, small or large. Whether you are now operating Diesels or planning an installation it will pay you to include "Alnor" Pyrometers as part of your engine equipment.

WRITE FOR CATALOG

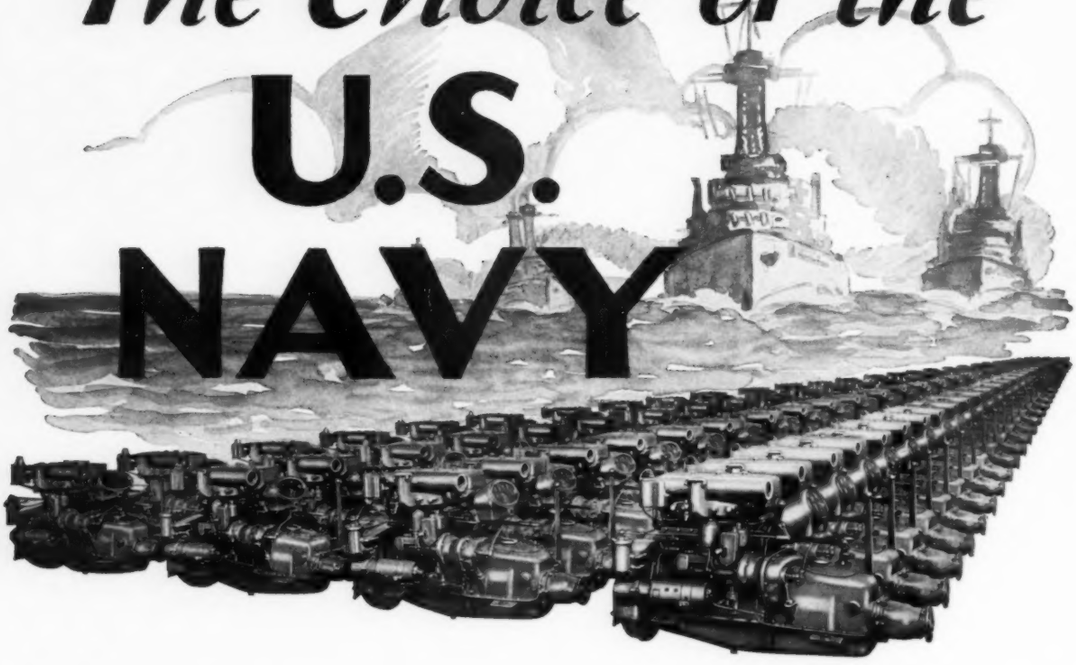
ILLINOIS TESTING LABORATORIES, Inc.

423 North LaSalle Street • Chicago, Illinois

Testing Engineers and Manufacturers of "ALNOR" and "PRICE" Pyrometers
The Products of 36 Years' Experience

"Alnor" Pyrometers — *The Engine X-Ray*

The Choice of the U.S. NAVY



AFTER a period of investigation covering seven years and involving research into the products of American Diesel Engine Manufacturers the U. S. Navy has selected and purchased Buda Diesel Marine Engines after exhaustive and severe tests for the eventual replacement of existing gasoline engines in power and motor launches.

Here is an endorsement that a boat owner cannot afford to overlook. Service that will meet the exacting demands of Naval Experts will more than meet your requirements. Let us tell you more about Buda Diesel Engines, the choice of the Navy.

Every boat owner or prospective boat owner should know the complete story of how the Navy determined on Buda Engines for small boat service. Let us send it to you.

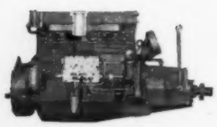
THE BUDA CO.

Marine Engine Division XK

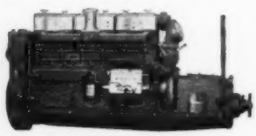
HARVEY (CHICAGO SUBURB) ILLINOIS

BUDA SILVER CROWN **MARINE ENGINES**

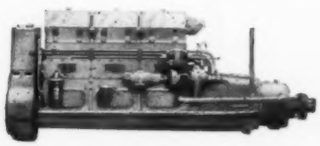
32 to 40 H.P.



85 to 100 H.P.



112 to 150 H.P.



152 to 180 H.P.

BURLINGTON ZEPHYRS

Excellent service given by ERIE crankshafts in Burlington Zephyr engines built by Winton Engine Corporation prove their superior quality.

CRANKSHAFTS

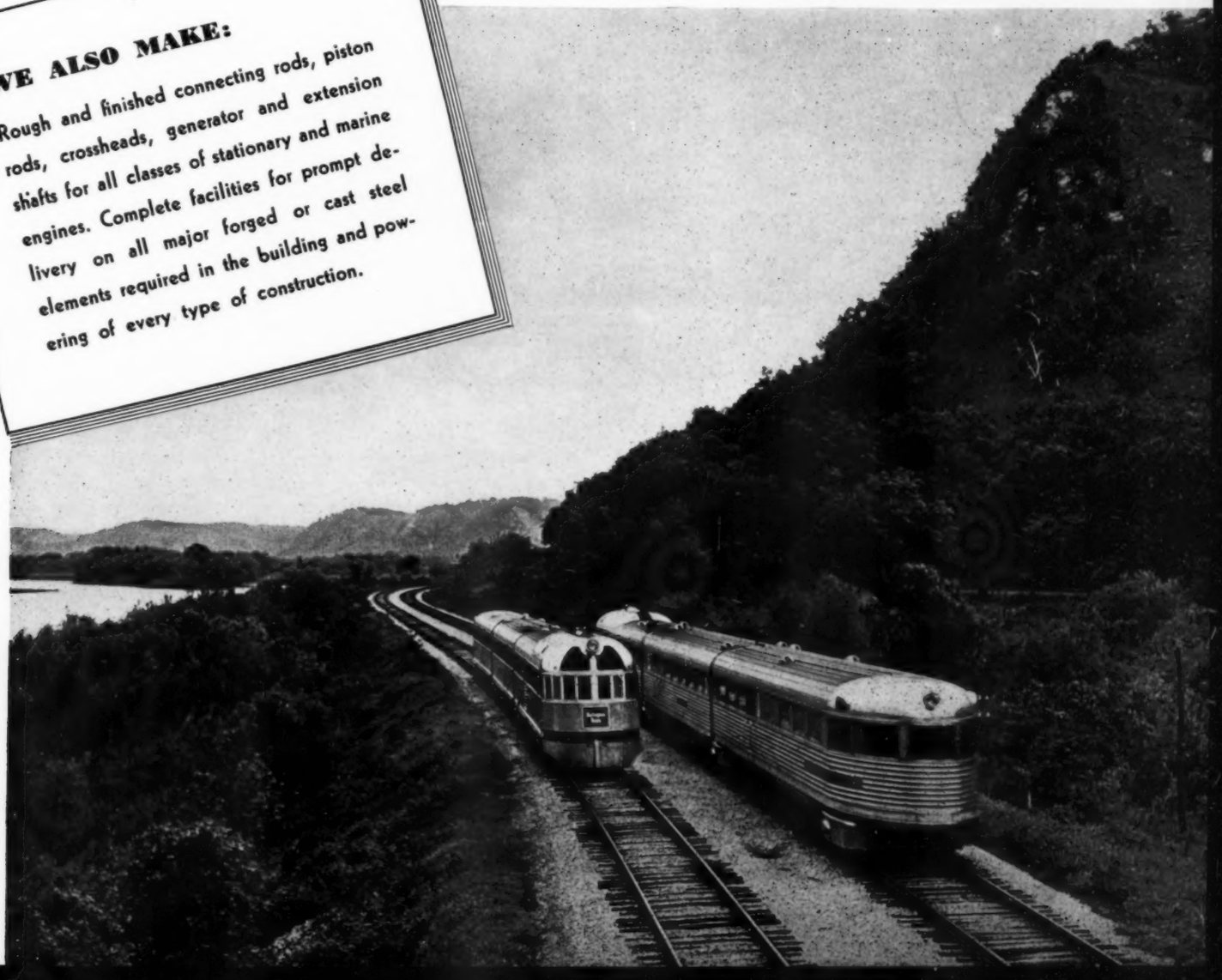
Leading engine builders everywhere specify Erie crankshafts and other forged parts when fine quality and accurate finish are necessary.

ERIE FORGE COMPANY

ERIE, PENNSYLVANIA

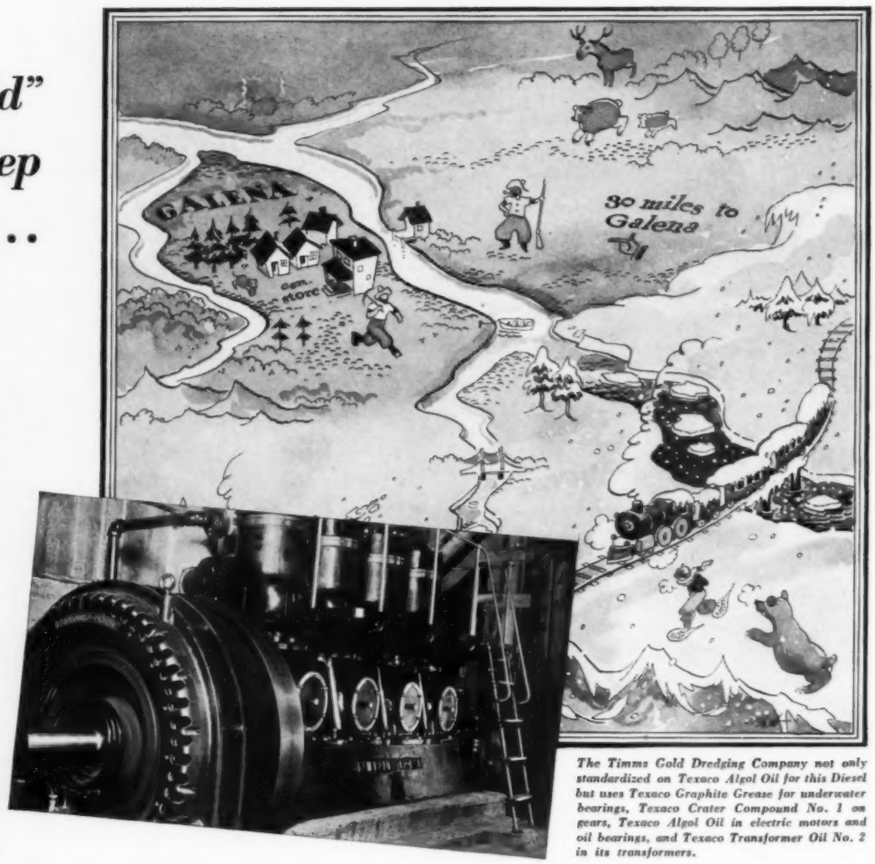
WE ALSO MAKE:

Rough and finished connecting rods, piston rods, crossheads, generator and extension shafts for all classes of stationary and marine engines. Complete facilities for prompt delivery on all major forged or cast steel elements required in the building and powering of every type of construction.



"Thar's GOLD in them thar Oils"

"No Diesel... no gold" ... so they had to keep this Diesel running...



The Timms Gold Dredging Company not only standardized on Texaco Algol Oil for this Diesel but uses Texaco Graphite Grease for underwater bearings, Texaco Crater Compound No. 1 on gears, Texaco Algol Oil in electric motors and oil bearings, and Texaco Transformer Oil No. 2 in its transformers.

This is no fairy-tale. There's gold in these oils for the Timms Gold Dredging Company of Galena, Oregon.

Snowbound for 90 days in every year . . . 30 miles from the railroad . . . this Diesel has to depend on the oils *on hand* for its continuous and *repairless operation.*

That is why, after trying many products, Mr. Timms, the President, finally selected Texaco Algol Oil because he wanted . . . had to have . . . continuous trouble-free performance from his only Diesel.

You, too, are assured of the same performance with Texaco Algol and Ursa Oils. They were developed and refined especially for Diesel operation. That means . . . that the harmful gum and carbon forming elements have been removed. Hence . . .

. . . they will not form gum and stick your rings.

. . . they keep rings free . . . give you maximum compression . . . greater fuel economy . . . and . . .

Free rings working in a tough, complete oil film cannot score cylinder liners.

More and more Diesel operators are finding this out. That is why more Diesels are lubricated with Texaco Algol and Ursa Oils than with any other brand.

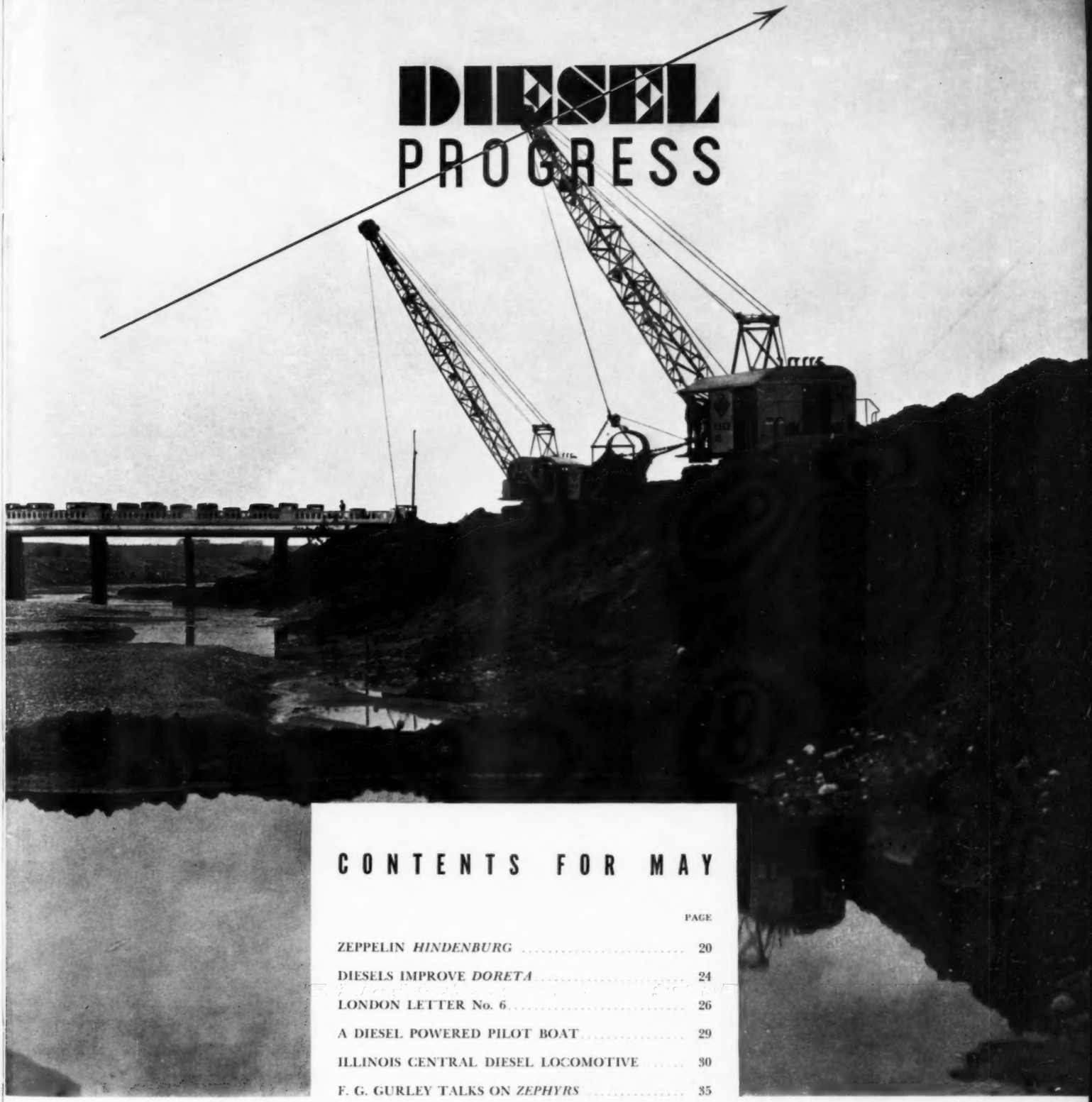
Give the Texaco representative an opportunity to prove the economies of Texaco Algol and Ursa Oils.

THE TEXAS COMPANY
135 East 42nd Street • New York City
Nation-wide distribution facilities assure prompt delivery.

TEXACO LUBRICANTS

for Stationary, Marine and Automotive Diesels

DIESEL PROGRESS



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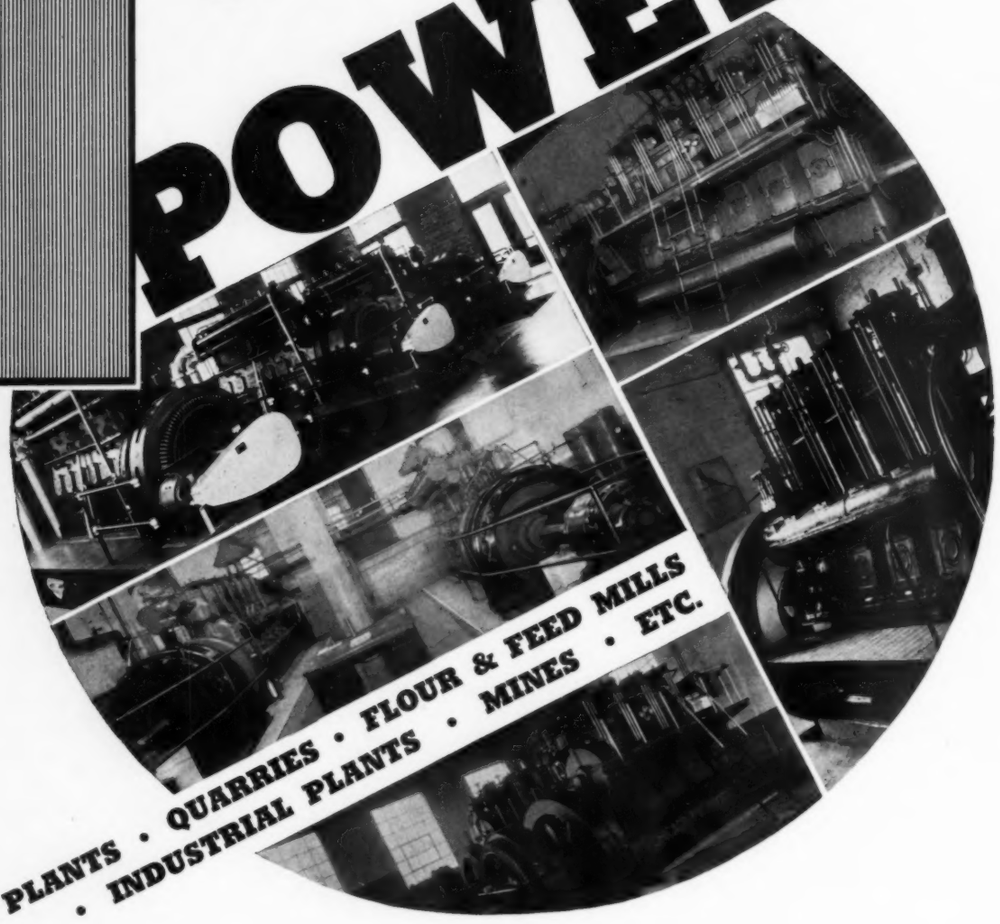
FRONT COVER ILLUSTRATION – The Zeppelin *Hindenburg* described in full detail on pages 20, 21, 22 and 23 of this issue. The largest Diesel powered airship in the world. Photograph by European.

The subscription price of DIESEL PROGRESS is $3.00 per year domestic; $5.00 per year, foreign. Executive Offices, 2 West 45th St., New York, N. Y.

1¢ ...OR LESS PER K.W.H.

POWER



In plants such as these, and in hundreds of others, CP Diesels are consistently producing dependable power for ONE CENT per K.W.H.—or less!

Let our experienced engineers study your power needs and prove the economy of CP Diesels. Your request for a survey involves no obligation.

CHICAGO PNEUMATIC TOOL COMPANY
ENGINE MANUFACTURERS FOR MORE THAN 30 YEARS

6 EAST 44th STREET
NEW YORK • N. Y.

CHICAGO PNEUMATIC DIESELS

M-1-36

NEW YORK, April 30th, 1936. Just one year ago to-day the first issue of DIESEL PROGRESS went into the mails, and with it went a fervent prayer, albeit a nervous one. It took a lot of nerve to start a new magazine in an already crowded field. It took even more nerve to turn out such a splendid appearing magazine, a book so beautifully illustrated, so well printed — so expensively produced.

But, in retrospect, it wasn't as big a gamble as it looked back there in April, 1935. The formula was accurate — to produce a better Diesel magazine, better edited, better illustrated, better printed and with more and better circulation.

To better serve the industry with which I have been associated for so many years; that was my main thought and effort. Everything I have to-day comes from my association with the Diesel industry. In my small way I have tried to earn my salt, I hope to continue earning my salt by serving my industry, to help it grow, to improve, to take its rightful place in the sun.

This May Anniversary issue, celebrating as it does, the successful conclusion of our first year of effort and the commencement of our second year, speaks for itself, it needs no brass band. Editorially it surpasses any of our previous issues, advertisingly it is a masterpiece.

To our readers who have supported us so royally through our first year and whose letters have been so helpful to me — my thanks and sincere appreciation and may you continue writing to me — your letters help so much. To our advertisers my thanks and congratulations — you saw a good advertising buy, you bought it and reaped the well earned benefit. To the advertisers who have NOT bought space in DIESEL PROGRESS to date may I leave the thought expressed in the old, old saying "Can fifty million Frenchmen all be wrong?"

Robert A. Hadsell, Jr.

Editor and Publisher

ZEPPELIN LZ-129 HINDENBURG

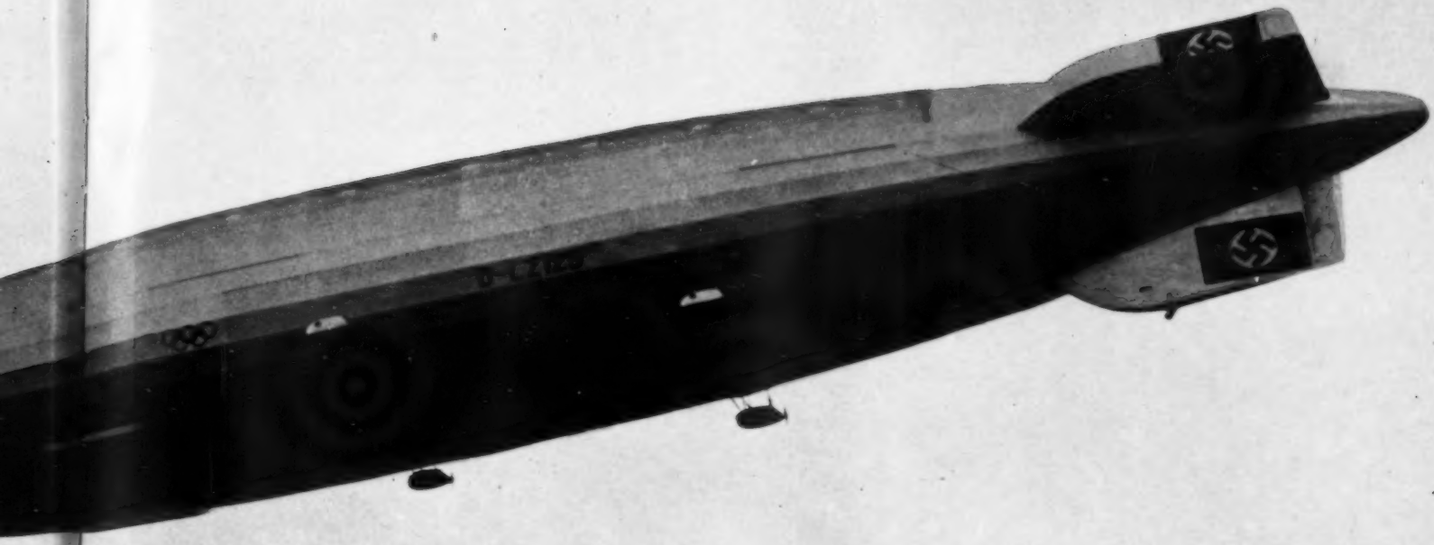
The newest trans-Atlantic airliner, equipped throughout with Diesel engines

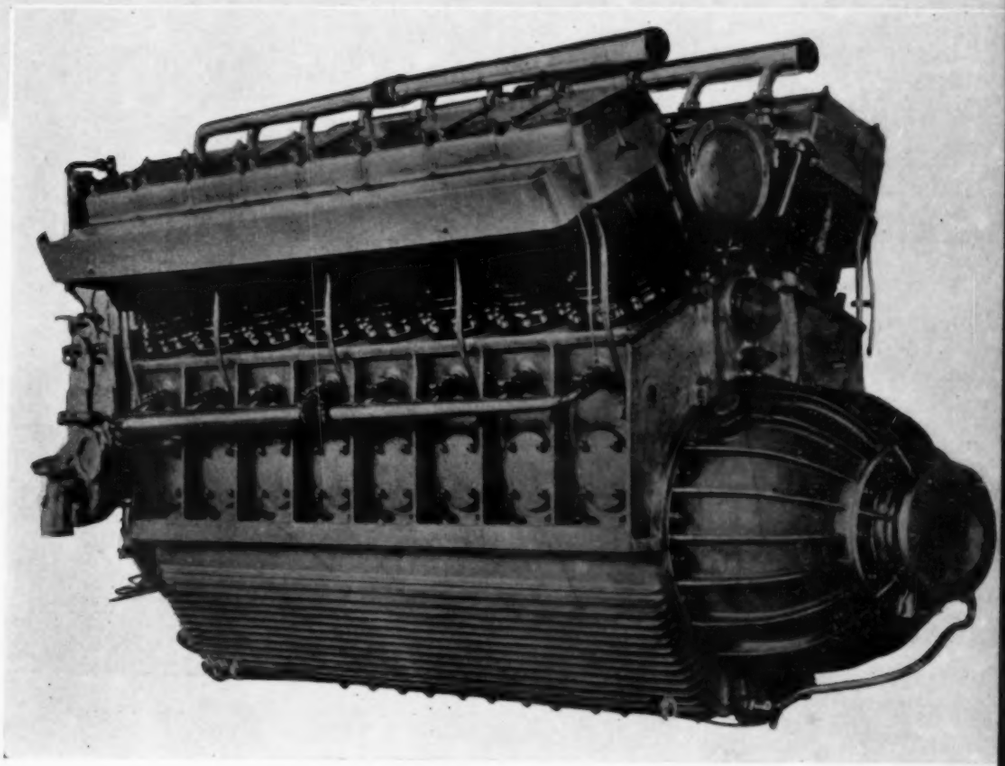
By PAUL H. WILKINSON

THE new Zeppelin LZ-129, the *Hindenburg*, has at last completed its first round trip flight across the South Atlantic, from Friedrichshafen to Rio de Janeiro and back — a distance of about 12,000 miles. While considerable publicity has been given to the breakdown of two of its four engines on the return trip, it is nevertheless greatly to the credit of the remaining two engines that it was able to reach its home port safely.

Apparently the *Hindenburg*, the engines of which were hardly broken in, was hurriedly pressed into service for an unexpected four-day election campaign tour over Germany. The brief interval which then intervened before its scheduled departure for South America was hardly adequate for the thorough overhauling of its engines after such a long shake-down cruise, and trouble developed — as is often the case with new engines before all the "bugs" are taken out of them.

This incident can hardly be taken to mean that the Diesel engines on the airship are unsatisfactory or unreliable. By the time the *Hindenburg* arrives at Lakehurst, N. J., early this month, undoubtedly the trouble will have been corrected and the engines will be in good shape for the frequent and lengthy trips which they will be called upon to perform.





Top — Side view of Zeppelin LZ-129, the "Hindenburg," leaving for South America.

Above — Three-quarter front view of the new 1,100 hp. Mercedes-Benz LOF-6 Diesel airship engine.

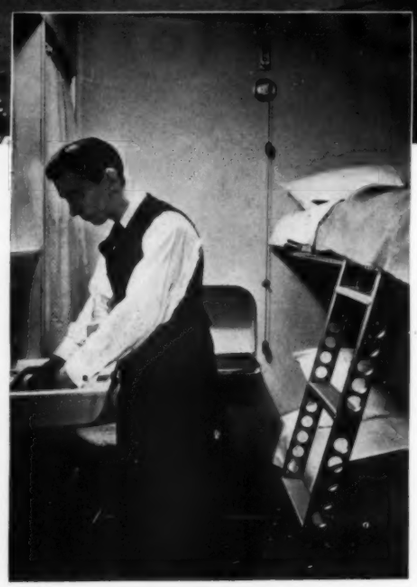
Left — View showing the dining room with its individual tables, and the promenade with its sloping observation windows.

View of the "Hindenburg" in its hangar, showing the method of suspending the engine cars.

The structure of the new airship is very similar to that of its predecessor, the LZ-127, *Graf Zeppelin*, as to the general arrangement of its main rings, intermediate rings, and central and lower corridors. The strength-to-weight ratio, however, has been considerably increased by the improved qualities of the aluminum alloy used in the girders, and by many refinements in design.

The framework consists of thirty-six longitudinal girders, with a central corridor through the axis of the airship which ties together the seventeen main rings and the nose and tail sections. The lower corridor, along the bottom of the framework, is used for communication purposes, and along it are located the fuel and water tanks, electric power plant, and crew's quarters.

The control car is underneath the bow of the airship, with the commander's room in front, and behind it the navigation room. Above the control car, in the body of the airship, is the radio room equipped for long and short wave and radiophone communication. A mechanical telegraph system, with indicators in the control room and in the four engine cars – similar to that used on a steamship – is used to control the engines. The elevator and rudder controls can be operated manually or by electric power. The central station of the telephone system is also located in the control car, and connects with fourteen stations in important parts of the airship such as the engine cars and electric power plant.



Interior of one of the two-berth staterooms.

The electric power plant consists of two 50 hp. Mercedes-Benz Diesel engines, each coupled to a 33 kw. 220 volt DC electric generator. The engines are completely cowled in, and the room itself is fireproof. Power is provided for lighting, heating, cooking, and the other needs on a large ship.

As mentioned in the November issue of DIESEL PROGRESS, four of the new Mercedes-Benz *LOF-6* Diesel engines, built by Daimler-Benz of Stuttgart, are used to drive the airship. The illustration shows the engine to be of conventional, sturdy construction, with its sixteen water-cooled cylinders arranged in two banks, with two inlet and two exhaust valves per cylinder operated by overhead camshafts. It has a geared drive, ratio 2: 1, and unlike the engines used on the former American airships, it is reversible. A four-bladed wood propeller, 19 ft. 8 ins. in diameter, is used on each engine. Starting is by compressed air.

The power cars are suspended below the body of the airship, two on each side, as shown in the illustration. Access is obtained by catwalks leading from the lower corridor, and there is sufficient room in them to make any necessary adjustments during flight.

The total power available to drive the airship is 4,400 hp., each engine developing 1,100 hp. at 1,500 rpm. The weight of the engine is 4,320 lbs., or 3.93 lbs. per hp. The fuel consumption should be from 0.40 to 0.35 lbs. per hp. hr., using Diesel fuel of approximately 0.860 specific gravity.

It has been remarked that the engines are particularly quiet in flight compared with the gasoline engines on the *Graf Zeppelin*. This is probably due to the quieter exhaust of the Diesel, and to highly efficient exhaust manifolds and silencers.

The landing gear is quite different from that used on previous airships, and follows airplane practice. Two pneumatic tired landing wheels, 4 ft. in diameter, are used — one underneath the control car at the front of the airship, and the other underneath the lower fin at the rear. This enables "power-on" landings to be made (with the engines running), and greatly increases its ability to maneuver on the ground. The landing wheels are retractable during flight to reduce head resistance.

The interior arrangements for the fifty passengers are shown in the cut-away views herewith. The passengers enter their quarters in the lower central portion of the airship by a gangplank which is lowered from the lower, or "B" deck. Wide stairways lead to the upper, or "A" deck, on which are located the public rooms and the staterooms.

The twenty-five two-berth staterooms are excellently appointed, with folding desks and folding washbasins with hot and cold running water, chairs and clothes closets. The upper berth, shown in the illustration, can be rolded up, like that in a Pullman, and the lower berth used as a settee in the daytime. All staterooms are "inside," and are air-conditioned and heated by hot air under the control of the passenger.

Sloping observation windows of shatterproof glass along the entire length of the promenades on each side of "A" deck afford an excellent view. Adjacent to the promenade on the port side is the dining room, shown in the illustration, which seats thirty-four people comfortably at individual tables. Service is provided from a serving pantry located over the kitchen on the deck below to which it is connected by stairs and an electrically-operated dumbwaiter. On the starboard side are the lounge, and the reading and writing room.

The smoking room and bar are on "B" deck, where one can enjoy an "LZ-129" cocktail and smoke in comfort. Sloping observation windows permit an excellent view of the terrain below. Automatic ash trays are provided, and the "air-lock" door, under the control of the steward, guards against lighted cigars or cigarettes being taken into other parts of the airship where smoking is forbidden.

The kitchen is located on "B" deck, all cooking being done by electricity. The electric stove has two baking ovens, one warming oven, and four hot plates. There are also several electric refrigerators for meats and other perishables.

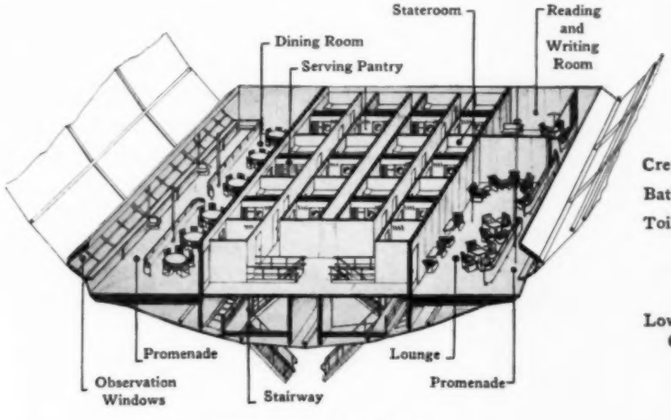
On "B" deck are the toilets, and one of the outstanding innovations on the airship — the shower bath. The officers' and crew's mess rooms are on this deck also. The sleeping quarters of the officers are above the control car, and those of the crew are further aft along the central corridor. The airship's complement is 40 men.

The *Hindenburg* has a length of 813 ft. and a maximum diameter of 135 ft., the volumetric capacity being 6,710,000 cu. ft. or nearly twice that of the *Graf Zeppelin*. The total lift is 236 tons, of which 71 tons is Diesel fuel for the engines. The maximum speed is 84 mph., the cruising speed is 78 mph., and the flight range is 8,700 miles.

The *Graf Zeppelin* takes from 96 to 108 hours for the westbound trip from Germany to South America, but the *Hindenburg's* schedule from Frankfort to Rio de Janeiro calls for the flight to be made in about 80 hours. On the North Atlantic route, the westbound trip from Frankfort to Lakehurst is estimated to take from 65 to 70 hours, and the eastbound trip from 45 to 48 hours.

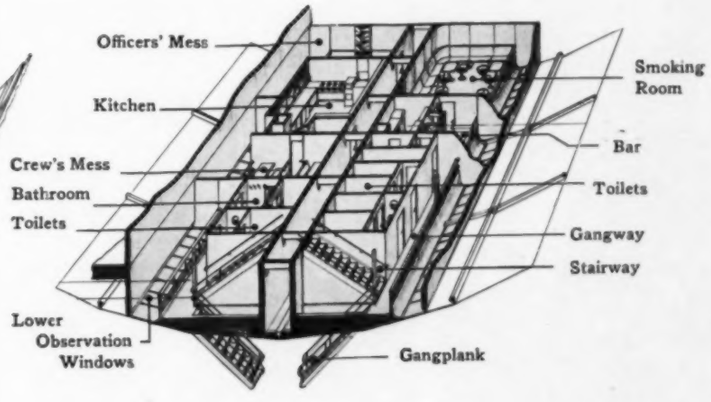
Deutsche Zeppelin Reederie (the operating company) has scheduled ten round trip flights for the *Hindenburg* between Germany and the United States by the end of October of this year. On its first North Atlantic flight, the *Hindenburg* will leave Frankfort on May 6th and is due to arrive at Lakehurst on May 8th. The choice between the northern (great circle) route of 3,900 miles, and the southern (Azores) route of 4,500 miles will depend upon weather conditions. The fares are $400 one way, and $720 round trip.

It is understood that work on the LZ-130, a sister ship to the *Hindenburg*, has already commenced, and it is hoped that it will be completed by the spring of 1937 to replace the *Graf Zeppelin*. Naturally, the LZ-130 will be Diesel-equipped throughout.



VIEW OF "A" DECK

Cut-away view of the upper, or "A" deck.



VIEW OF "B" DECK

Cut-away view of the lower, or "B" deck.

DIESELS IMPROVE DORETA

THE yacht *Doreta* is entering her eighth season of service and to any casual observer appears quite the same as at any other time in her history. To her owner, Mr. D. F. Wheeler, however, she is quite a different vessel. Instead of paying $6.00 per operating hour for fuel, Mr. Wheeler now pays only $1.15 effecting a saving of over eighty per cent. The solution, of course, is a pair of Diesel engines and thereby hangs a tale which should most certainly be of intense interest to every yacht owner who at present is burning gasoline and finds it excessively expensive.

The *Doreta* was built by the Mathis Yacht Building Company in 1929 from designs of John R. Wells, N.A., and delivered to Mr. C. S. Hornbeck, her original owner, in October of that year. She was then called *Sahlou* and immediately proved herself to be an extremely comfortable and satisfactory craft. Two years later she was purchased by her present owner, *Sahlou* was changed to *Doreta*, and six years of quite intensive operation ensued. During this period, since much time was spent under way, charges for gasoline were ever present major items of expense. Thus it was that in the fall of 1935, Mr. Wheeler retained the firm of Sparkman & Stephens, Inc., Yacht Brokers and Naval Architects, and presented them with the following problem: He desired, in brief, to retain *Doreta* which he considered ideal for his requirements; he wished to avail himself of the drastic economy possible by using Diesel engines; he insisted upon a cruising speed of 14.5 miles per hour necessary for *Doreta* to clear her own wake; and, finally, he did not want to remodel the interior of his boat to accommodate new engines.

After due consideration it was decided to replace the pair of 350 hp. gasoline engines with two eight-cylinder Fairbanks-More Diesels rated at 160 hp. each. Regardless of the considerable reduction in power, the cruising speed requirement was met with ease although top speed was reduced by several miles which was no objection. The only change in the engine

Interior views of the "Doreta" showing the tasteful decorations executed by Miss Helen Novak.

Diesel yacht "Doreta" in port and a corner of the comfortable main living saloon.

room was the increased space left by the Diesels, which was most appreciated by the Captain, responsible for their maintenance and operation.

The task of converting was ably handled by Mr. Robert Jacobs of the Jacobs Shipyard, City Island, and the Diesels were installed and running in January, 1936. *Doreta* left soon after for southern waters where she has been in commission all winter in and about Miami Harbor with occasional cruises to Nassau and adjacent waters.

Doreta measures 80 feet overall and only slightly less on the waterline due to a plumb bow and transom stern. She has a beam of 15 feet and 3 feet, 9 inches draft. She was designed for one man operation with helm and engine controls located on the bridge. All cabins have full head-room and provide sleeping accommodations for four to six persons of the owner's party.

The illustrations portray much more clearly

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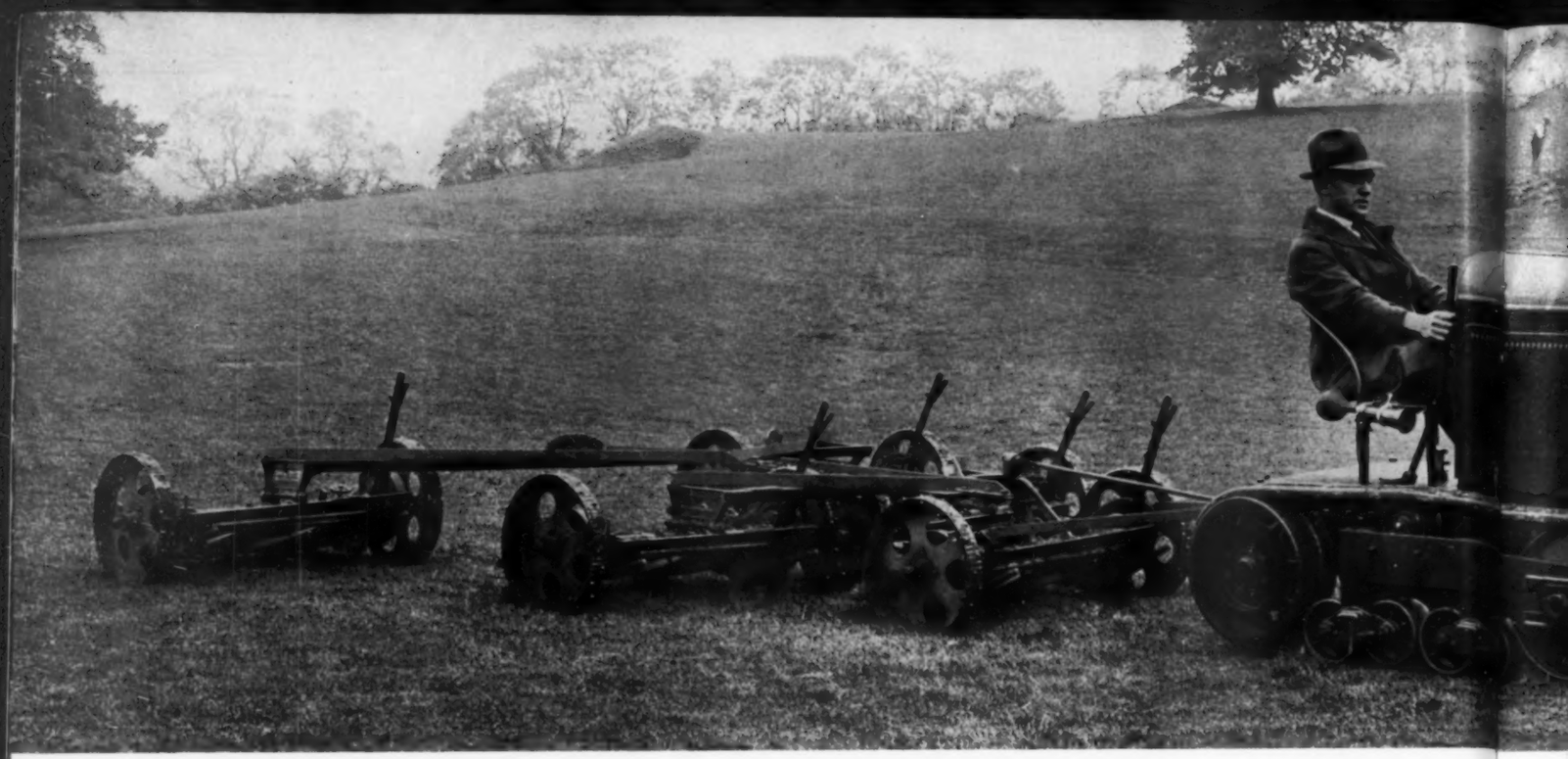


Citroen-Kegresse grass track-laying tractor whose motive power is provided by an 8-12 hp. Ailsa Craig engine, at work on a golf course.

LONDON LETTER NO. 6

By GEORGE LIND

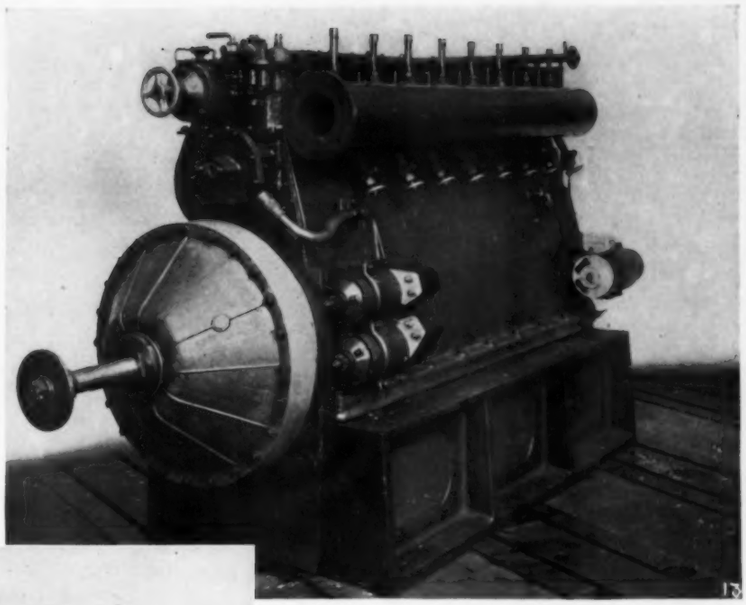
PREVIOUS articles in this series have dealt with the uses to which large and medium sized Diesels can be put, but the field of the small unit still remains to be considered. London Letter No. 6 is, therefore, intended to bridge the gap, its subject matter consisting of a miscellaneous collection of Diesel applications for which small units are particularly suitable.

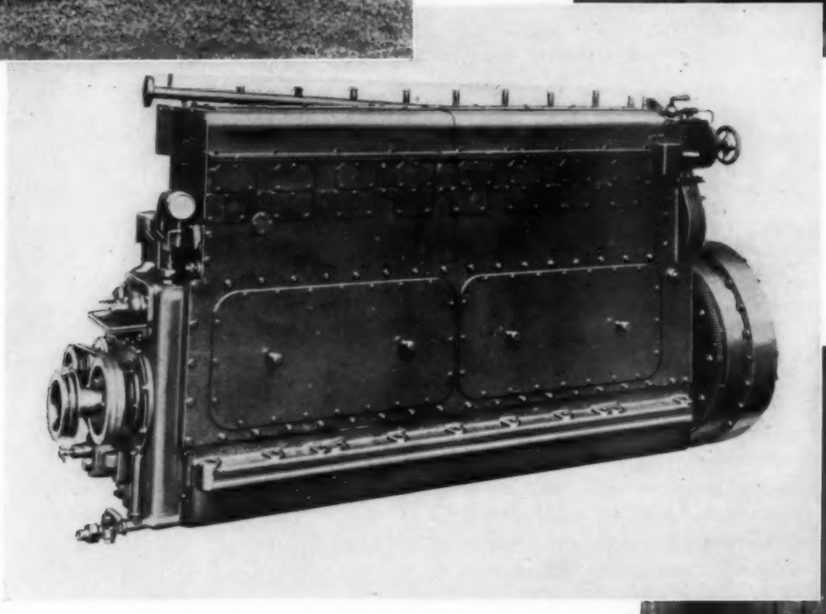
First on the list come shunting locomotives. Strictly speaking these machines are in a category of their own, but as they could hardly justify a complete London Letter to themselves they will be included here. At the present time the Diesel engined shunting locomotive is rapidly ousting its steam rival from the European railroads. Its simplicity, reliability, efficiency and general hardiness place it far ahead of any steam driven counterpart, and even the most conservative railway companies are at last realizing the great savings that await a change over to Diesel power.

In England, by no means the most progressive country in this respect, the greatest credit goes to the London Midland and Scottish Railway who have over 50 Diesel-engined shunting locomotives now at work. A typical example of their larger type of machine is the Allen-Drewry 25-ton model, designed to pull loads of up to 500 tons. The engine of this loco is a very workmanlike straight eight of 5.73 ins. bore and 7.1 ins. stroke developing 160 bhp. at 1,200 rpm. An outstanding feature is the use of a frame shaped like the letter C, which allows the crankshaft to be removed from one side of the unit when the inspection doors are unfastened. For the valve operation a duplex chain is used, the camshaft being located high up in the cylinder block casting. Each cylinder has four valves, two inlet and two exhaust, the C.A.V.-Bosch atomizers being placed centrally in the cylinder heads. The pistons are of cast iron and the connecting rods have the white metal run directly into them. A 24-volt 200-amp.-hr. storage battery provides power for starting and is charged from a C.A.V.-Bosch generator driven from the front end of the engine. Assembled as a unit with the flywheel is a Vulcan-Sinclair hydraulic traction coupling from which the drive is taken via a Wilson-Drewry epicyclic gearbox and worm and wormwheel reduction to the jackshafts. The rail speeds given by the four gearbox ratios are 2 mph., 5 mph., and 13 mph.

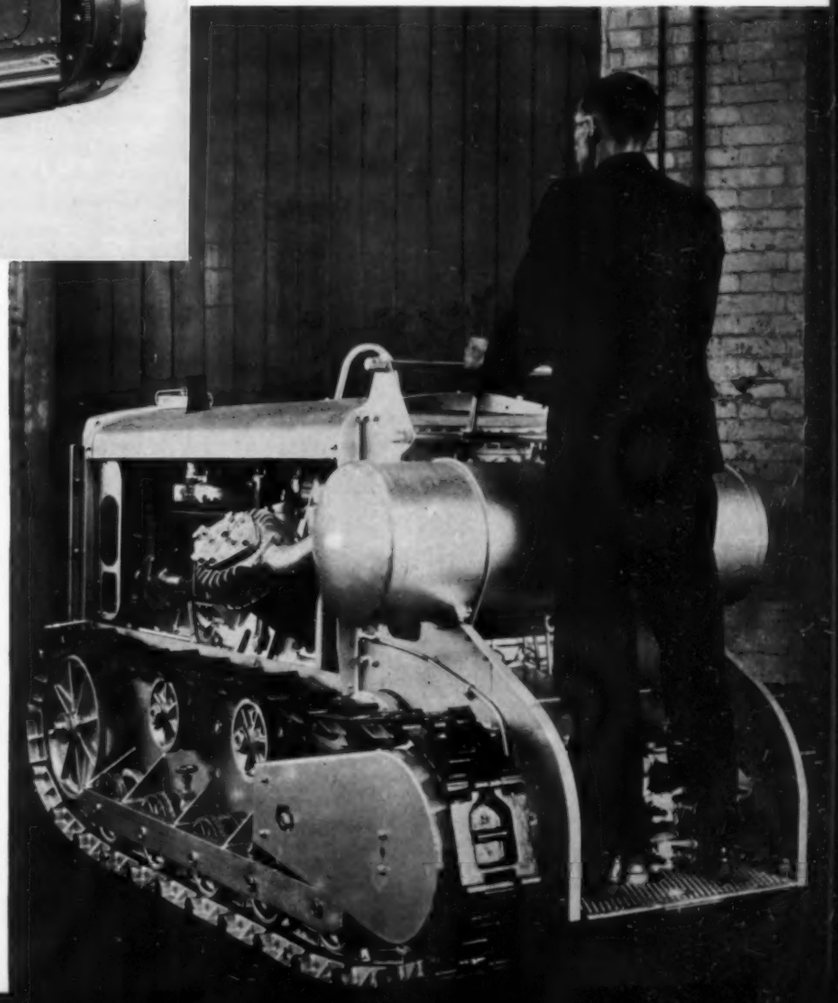
In the course of its duty this loco runs continuously from Monday morning to Saturday night, a total of 132 hours. Sundays are reserved for maintenance work, the usual time taken being about 6 hours. The fuel consumption works out at just over a mile to the gallon, and, needless to say, represents a 30 per cent saving as compared to a steamer of similar power.

Another highly successful design of loco is built by the Hunslet Engine Co., Ltd., of Leeds. This concern specializes in the production of shunting engines of all types, and their sales are well above those of any other manufacturer. In the accompanying illustration one of a batch for the L.M.S. is shown, this particular model being powered with a 160 bhp. 6-cylinder M.A.N. engine. The clutch is of the friction type and the hydraulically operated gearbox provides four speeds forward and one





Above — Straight-eight Allen engine. Note Vulcan-Sinclair hydraulic coupling and two starter motors. Center — 160 hp. Allen straight-eight engine. The covers shown here are removable giving full access to the connecting rods and crankshaft. Below — Ingersoll-Rand Crawl Air powered by a 4-cylinder Waukesha Hesselman engine.



reverse. Below is given an operating cost schedule for one of these engines as obtained under test in the L.M.S. yards at Preston.

	Hrs. Worked	Mileage	Fuel @ 8 cents per gal.	Lube oil including starting compression, etc.	Petrol for starting engine @ 31 cents per gal.	Sand
Weeks total	144½	174	172 gals.	11.054 gals.	.92 gals.	675 cwts.
Cost			14.32 $	6.8 $	29 cents	61 cents

Total cost 22.02 $ or 14.6 cents per hour.

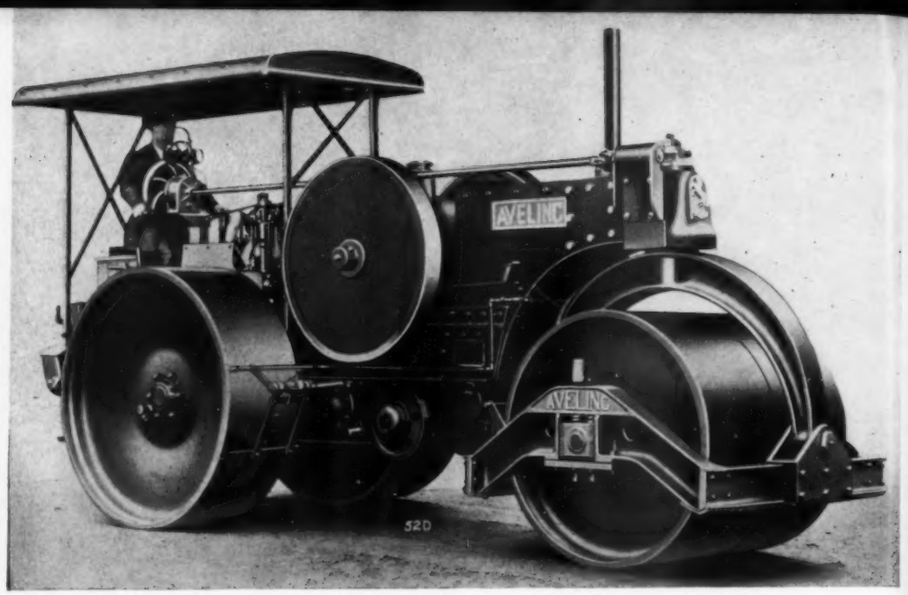
Yet another popular type of loco is that made by Hawthorn, Leslie & Co., Ltd., of Newcastle-on-Tyne, employing Diesel engines built by the Leeds firm of J. & H. McLaren, Ltd. Many of these machines have been exported to the Colonies where they are giving excellent service under all sorts of climatic extremes. The

McLaren engine is a medium speed 4-stroke unit of sound and sturdy construction with overhead push-rod operated valves and detachable cylinder heads, the sizes ranging from a 2-cylinder developing 35 bhp. to an 8-cylinder developing 140 bhp. One point of particular interest is the injection arrangement which employs the Daimler-Benz patented combustion system. In this design the injectors are mounted in specially inclined pre-combustion chambers. At the lower end, funnel-shaped perforations in a flame plate communicate with the main combustion chamber. It is claimed that the high combustion pressure in the pre-combustion chamber forces the fuel through the peculiarly drilled flame plate holes in such a way and at such a temperature that the combustion in the main combustion space is complete at all camshaft speeds.

On the Continent conditions as regards shunting locomotives are altogether different. In England a shunting engine is expected to haul loads of up to 600 tons, but in France or Germany, say, where the freight trains are much heavier, the loads often reach as much as 900 or 1,000 tons. For this purpose the locomotives must be very much more powerful. Generally speaking, Continental practice calls for outputs of between 300 and 500 bhp., and in the majority of cases Diesel-electric transmission is used.

So much for shunting locomotives. By way of contrast here are some details of a recently introduced range of British Diesel-engined road rollers – representative of another field in which Diesel power is rapidly superseding steam. The machines in question are built by one of the oldest and most flourishing road roller manufacturers in the country, Aveling-Barford, Ltd., of Grantham.

A typical example of the range is the model D-R which has a weight of 15 tons. The engine is a single cylinder horizontal four-stroke developing 32 bhp. at 400 rpm., and is started by compressed air. The cylinder head carries two push-rod operated valves and the renewable cylinder liner is of close-grained cast iron. The piston is also of cast iron. From the engine crankshaft the power is transmitted by a duplex roller chain to the clutch shaft of a four-speed oil bath gearbox giving speeds of 3.25, 1.9, 1.3 and .8 mph. The gearbox is constructed of cast iron and has a large aluminium inspection cover for dismantling. The final drive is taken from a pinion on the gearbox to a cast steel gear wheel secured to the back axle.



Aveling-Barford road roller, 15 tons, single-cylinder 32 bhp. Diesel engine.

For the last two or three years much of the Diesel engine manufacturer's most profitable business has been carried on with the makers of portable compressed air sets. For this, the revival in roadmaking is, no doubt, largely responsible. Of the many different types of set available today, two deserve mention here, namely the Ingersoll-Rand Crawl Air Compressor and the Armstrong Whitworth portable set. The first of these, the Crawl Air, is an American production, but owing to its sterling qualities it has won a great reputation in this country. It comprises, briefly, a 4-cylinder Waukesha-Hesselman engine coupled to an air-cooled two-stage compressor. It is self-propelling moving on two tracks, which are driven by reversible air motors. The maximum speed is about 2 mph.

The Armstrong-Whitworth portable set is built in two sizes with capacities of 130 cu. ft. per min. and 150 cu. ft. per min. As opposed to the Crawl Air, it is water cooled. The engines used are Dorman-Ricardos, developing 28 and 36 bhp. at 1,200 rpm. respectively. Their construction is almost identical, both of them employing overhead push-rod operated valves, detachable cylinder heads, chromium cast iron cylinder blocks and nitrided cast iron cylinder liners, aluminium alloy pistons and C.A.V.-Bosch fuel pumps and injectors.

To complete this rather disconnected report, here are some facts and figures relating to the latest oil-engined Citroen-Kegresse track-laying tractor, specially intended for use on golf courses, sports' grounds, etc. The motive power for this exceptionally handy little machine is provided by an Ailsa Craig single cylinder 2-stroke engine developing 12 bhp. at about 1,250 rpm. The main feature of this unit is its extraordinary reliability even when left running for long periods at excessive loads. In order to make this possible great care is taken in the production of all engine parts, the whole unit undergoing an unusually long bench test before delivery. The design is in keeping with the workmanship and employs

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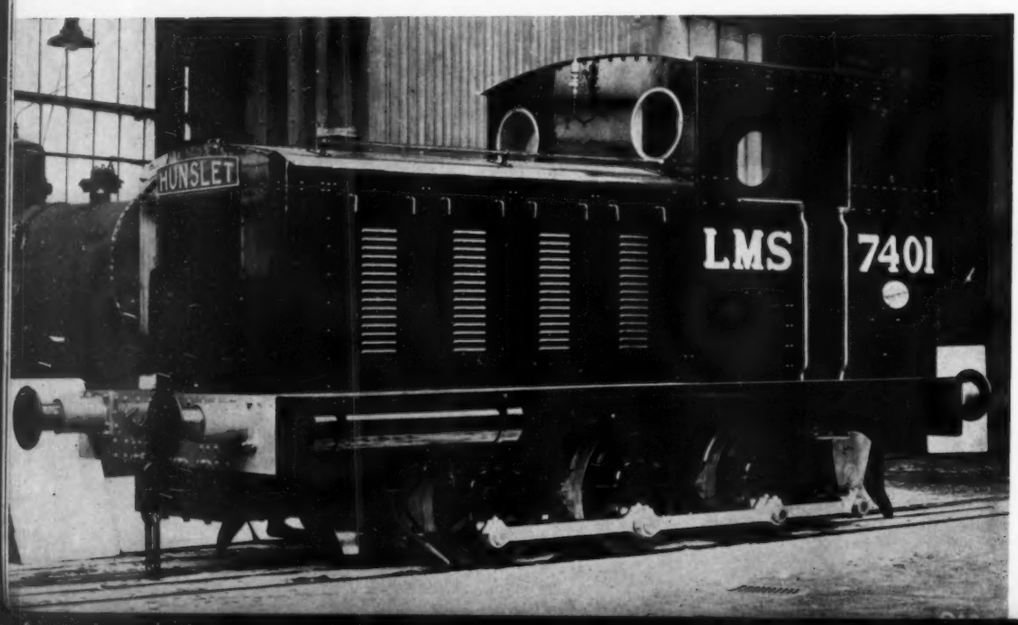
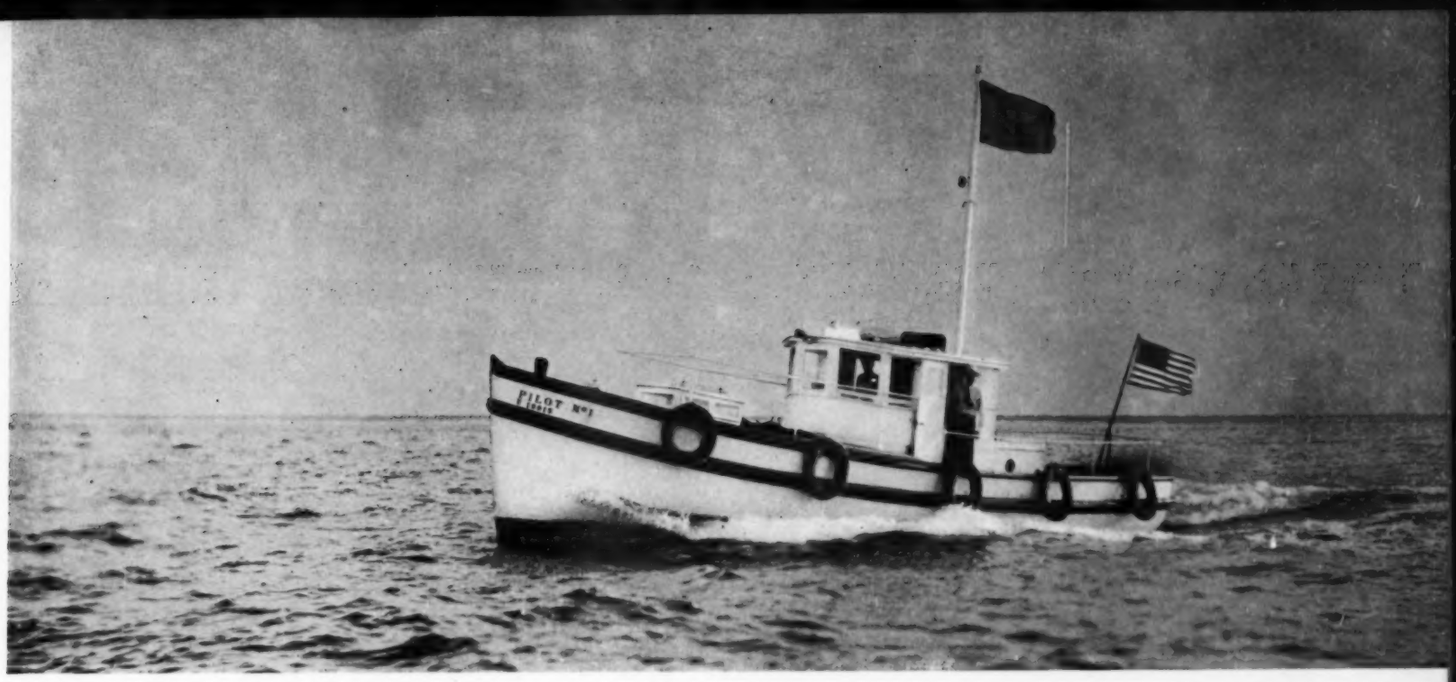


L.M.S. shunting engine powered with a 160 bhp. 6-cylinder M.A.N. engine.



A DIESEL POWERED PILOT BOAT

By LEE HARDIMAN

ONE of the most interesting installations of a Diesel engine, recently completed, is that of a 6-cylinder, 4-cycle Winton Diesel in the boat owned and operated by the State Pilots at the Port of Jacksonville, Florida.

This boat was built in 1930 and powered with a 150 hp. gasoline engine. Her length is 40′ with 12′ beam and 4′ draft. She was re-powered in May, 1935, with a Diesel engine which turns a 28″ by 16″ propeller giving her a speed of 12 miles per hour.

The President of the Bar Pilots Association and all ten of the Bar Pilots who make use of this little vessel, are enthusiastic over her performance and are glad that the question of safety has been solved by the installation of a Diesel engine with, of course, the attendant economy which automatically goes with Diesel operation.

This pilot boat is constantly in operation under all weather conditions and dependability of operation is absolutely vital, and it is good to know that since she was re-powered her record of being on the job when needed has been exactly 100 per cent.

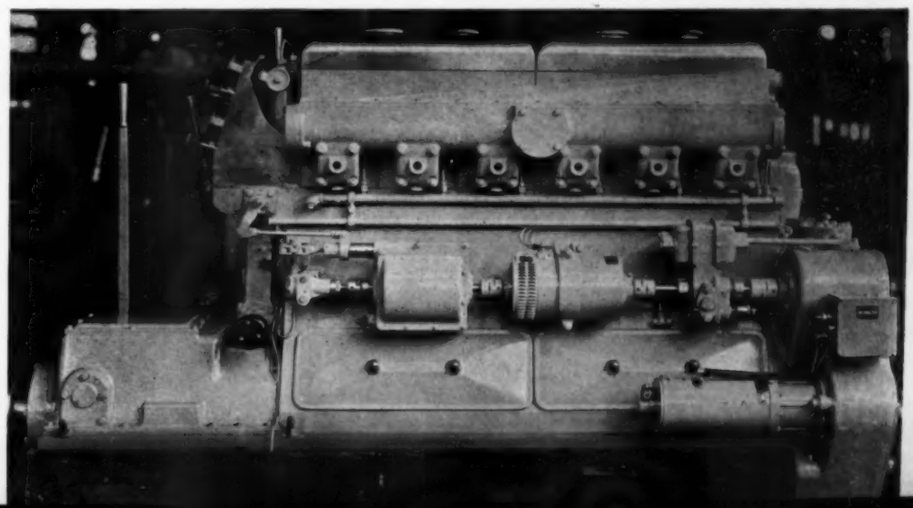
The Winton Diesel engine installed in this pilot boat typifies the modern type of light-weight, compact, high-speed, airless-injection Diesels which have recently come on the market and which are fitting in so excellently on reconditioned jobs of this kind.

Whilst this 6-cylinder 5″ by 7″ engine is comparatively light-weight, yet it is unusually rugged in its construction providing ample strength where necessary and is absolutely dependable for long, continuous operation.

The use of metal alloys makes possible light-weight, dependable, rugged engines such as this. For instance, the cylinder block is chrome nickel iron, the cylinders are likewise chrome nickel iron. The top crankcase is made of special aluminum alloy in one piece. The bottom crankcase is likewise of aluminum; and so the story goes, full advantage having been taken of the science of metallurgy in combining strength with light-weight.

A few years ago it would have been impractical to think of installing a 100 hp. Diesel engine in the space available in such a vessel as this pilot boat. Now the Diesel industry offers engines absolutely dependable, yet compact enough to replace gasoline engines of the same general rated horsepower.

A 6-cylinder, 4-cycle, 5″ x 7″, 100 hp. at 1,000 rpm. Winton Diesel engine installed in the Jacksonville pilot boat.



The new Ingersoll-Rand Diesel switching locomotive in active yard service for the Illinois Central Railroad.

NEW ILLINOIS CENTRAL DIESEL LOCOMOTIVE

THE initial tryout of the 1,800 hp. Diesel-electric locomotive placed in service in March by the Illinois Central Railroad included the successful handling of a 6,300-ton freight train in the transfer service for which it was purchased.

This locomotive has a total weight of 342,000 pounds. The two 3-axle trucks have Commonwealth Steel Castings and each of the axles is geared to a spring nose-mounted axle-mounted traction motor. The under-frame is of fabricated construction consisting of steel girders and plates welded together and designed to support the two engine-generator sets with a minimum deflection.

The cab is also of welded construction with suitable radiators at each end for cooling the circulating water and oil from the engines. The whole cab structure is supported on center plates by the two trucks. The draft gear is attached direct to the truck and pulling stresses are thus carried through the platform for only one truck. The platform is supported on four H beam channel sections 24¼ in. deep and weighing 120 pounds per foot. Portions of the web were reconstructed by cutting and welding to secure a tapered member. The floor sheets are of 3/16 in. sheet steel with suitable openings for a well construction for the mounting of the main engine sets.

Two 900 hp. Ingersoll-Rand engines are placed side by side in the central portion of the cab. A traction type DC generator is direct coupled to each of the engines with a 125-volt constant voltage auxiliary generator carried on an extension of the main generator shaft. Mounted on top of the auxiliary generator and belted to the main shaft is an exciter set which is used exclusively for supplying variable current to the main generator fields. A flexible coupling is used between the engine and the main generator.

The electrical connections for the generating units differ somewhat from the usual practice with dual engine locomotives in that the generators are connected in series with the mid-point grounded – thus the motors can be supplied with the full voltage of both generators but with half voltage to ground.

The control is three-speed, electro-pneumatic with automatic transition. The engine throttles are manually operated from each of the cabs. In handling this control the operator sets the master controller on one of the three connections, and as the locomotive accelerates, the control automatically moves to the higher speed positions – depending upon the maximum speed connection selected. Should one of the engines be shut down it is still possible to obtain maximum tractive effort and thus to handle the usual weight of train, but at reduced speed, by cutting out the unused generator. Protection to the equipment, in case of a ground, is provided by a grounding relay which removes the excitation on the main generator fields. The auxiliary generator is protected by an over-voltage relay.

The auxiliary generator providing 125 volts at all engine speeds, from idling to full speed, supplies power for the radiator fan motors, blower motors, compressors, lighting, control, cab heater motors, battery charging and excitation for the exciter.

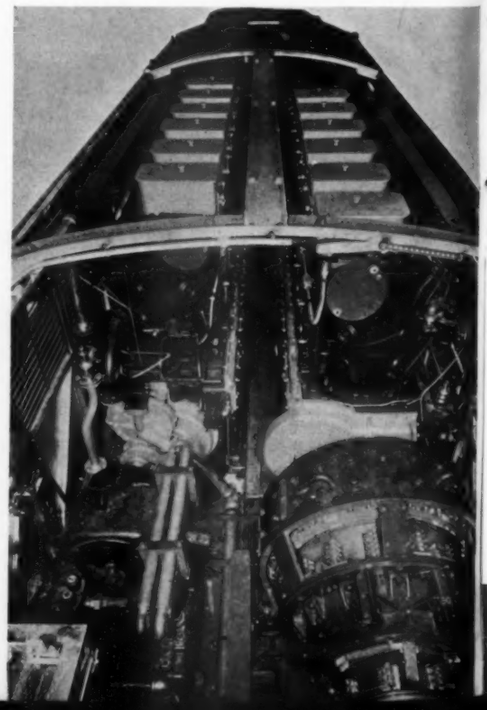
Following are the principle ratings, weights and dimensions of this locomotive:

Engines – Two Ingersoll-Rand 900 hp., 550 rpm., 4-cycle Diesels.

Locomotive Ratings:

Continuous Tractive Effort	38,800 lb.
Speed	13.8 mph.
One-hour Tractive Effort	44,400 lb.
Speed	12.0 mph.
25 per cent Adhesion Tractive Effort	85,500 lb.
Speed	5.1 mph.
Maximum Speed	60 mph.
Total Weight in Running Order	171 tons
Weight per Axle	57,000 lb.
Length Inside Knuckles	60 ft. 0 in.
Height	15 ft. 2 ins.
Width over Cab Sheets	10 ft. 0 in.
Total Wheel Base	48 ft. 0 in.
Rigid Wheel Base	11 ft. 0 in.

The locomotive was built, equipped and tested for the Ingersoll-Rand Company at the Erie Works of the General Electric Company.



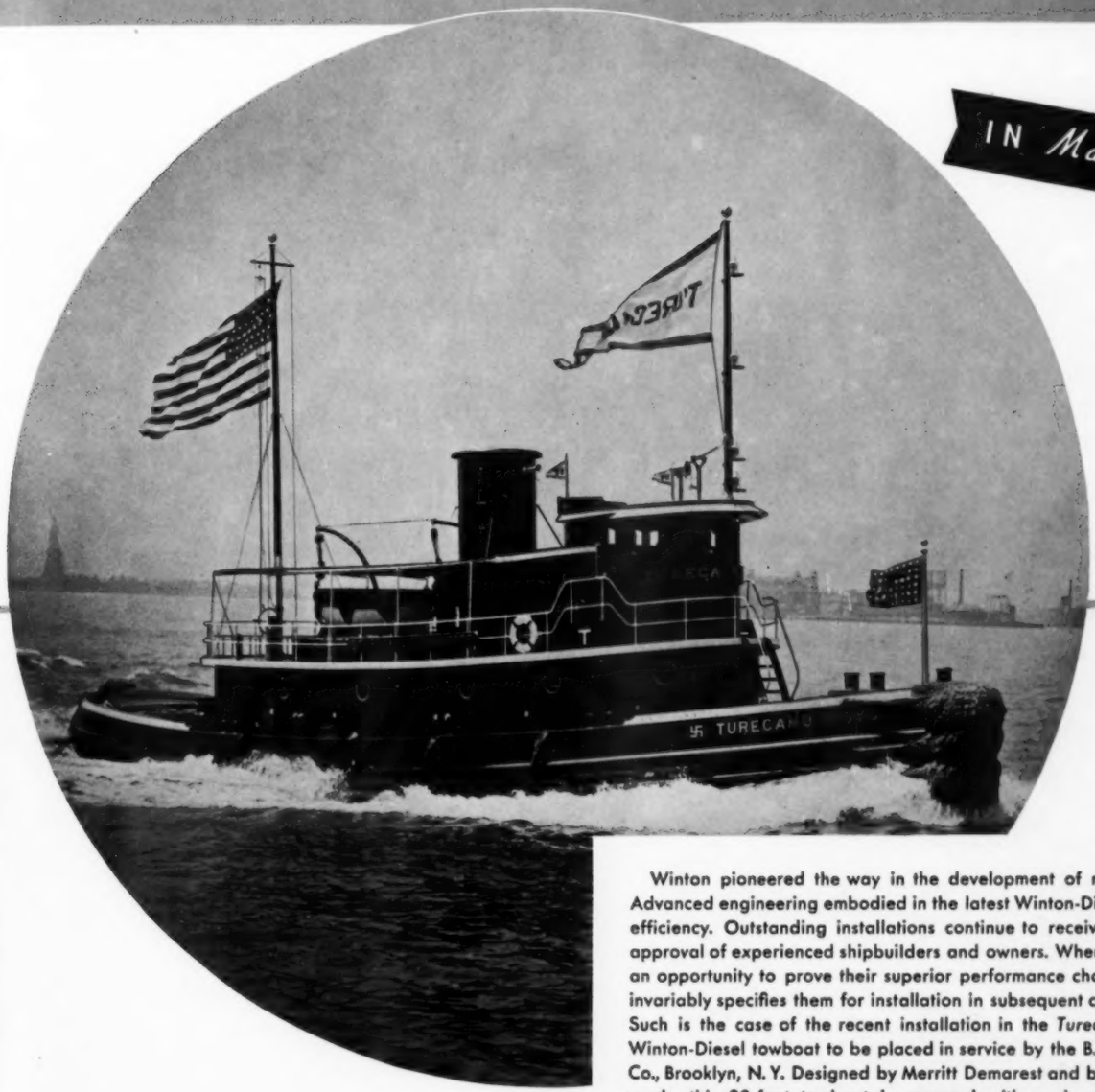
Top view through roof of cab showing unit partially assembled and interior arrangement of machinery.

WINTON-DIESEL ENGINES

meet many

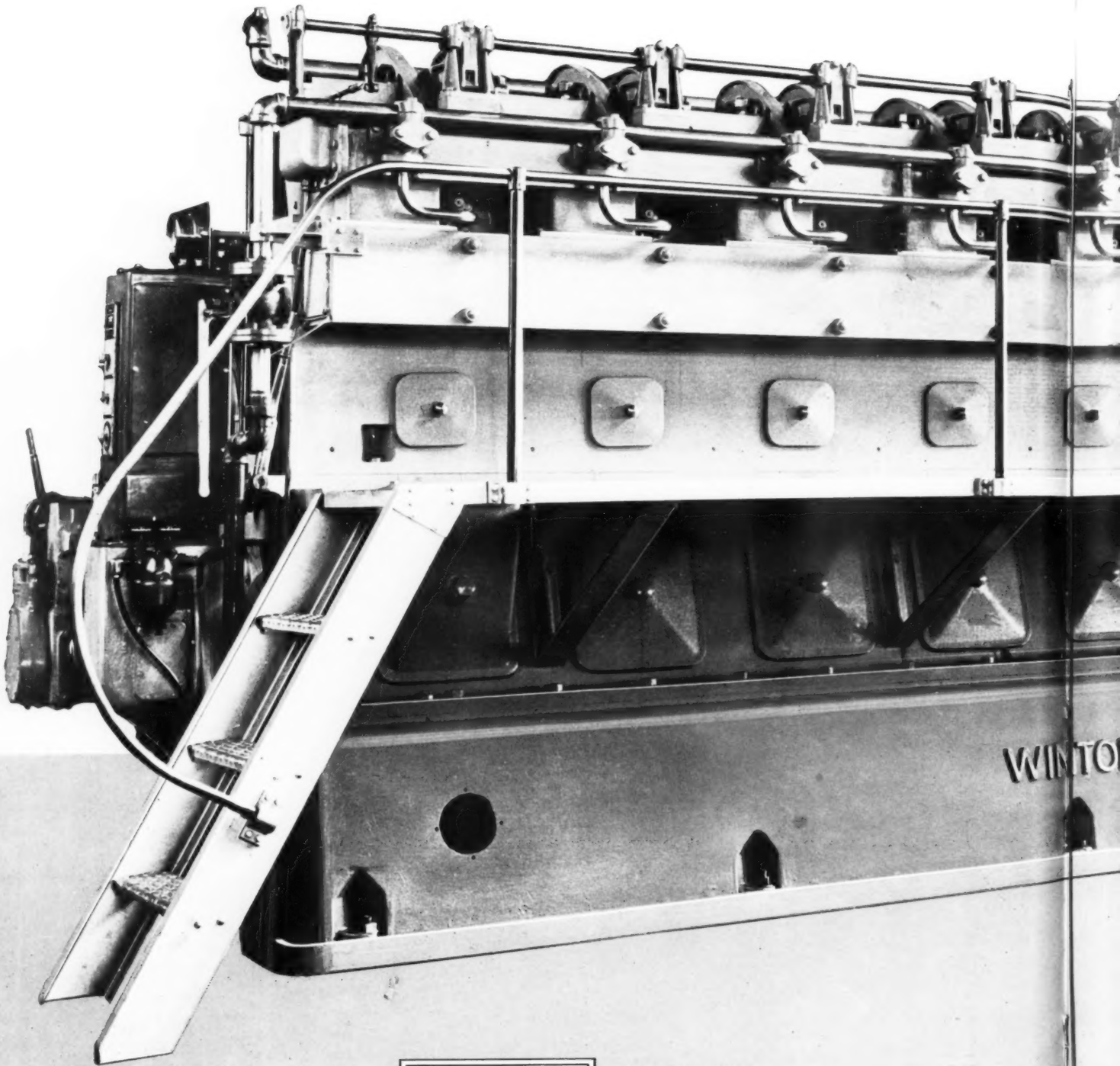
Diversified Needs

IN *Marine* SERVICE



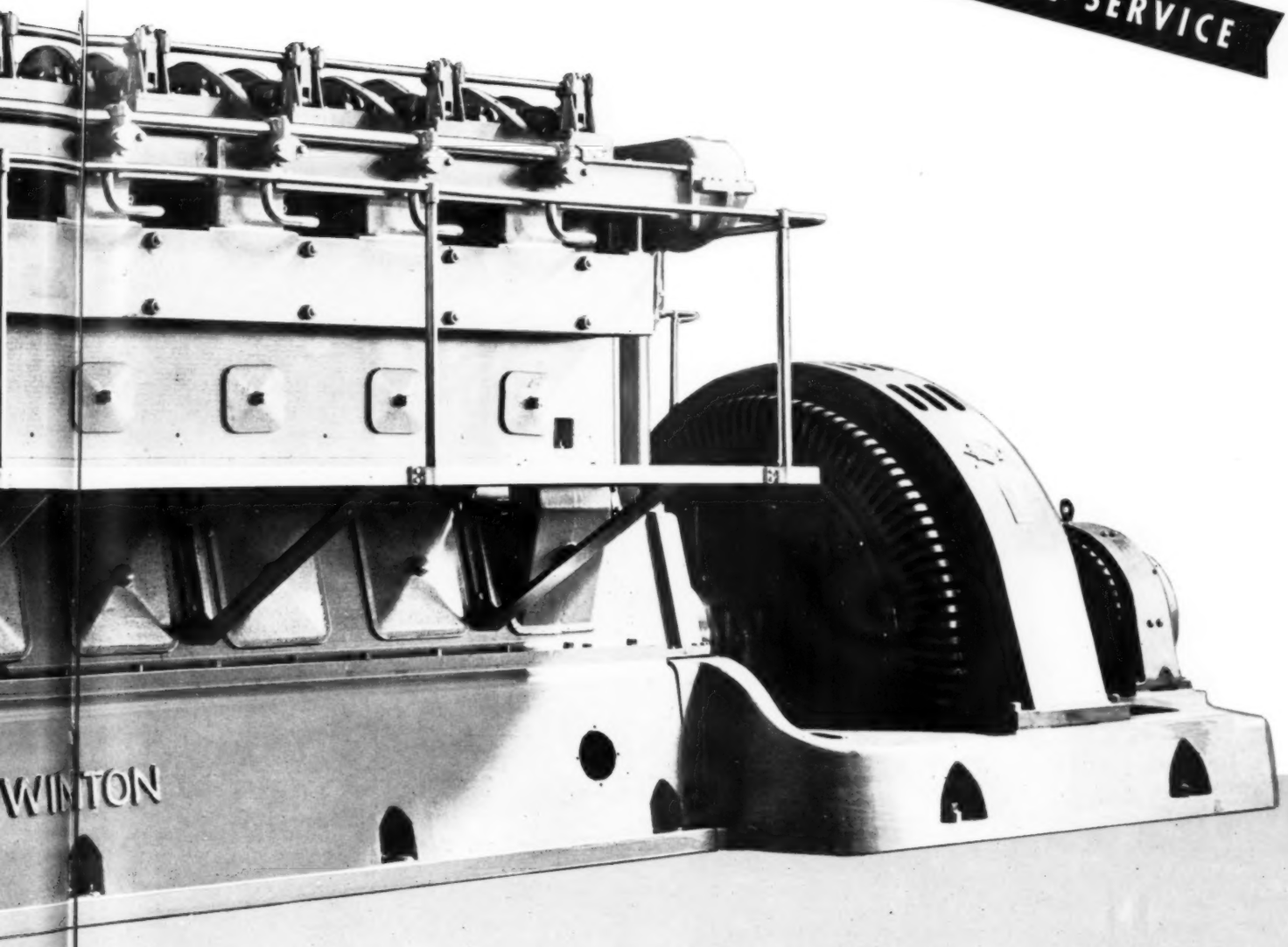
Winton pioneered the way in the development of modern marine power. Advanced engineering embodied in the latest Winton-Diesels insures workboat efficiency. Outstanding installations continue to receive the confidence and approval of experienced shipbuilders and owners. When Winton engines have an opportunity to prove their superior performance characteristics, the owner invariably specifies them for installation in subsequent craft to carry his name. Such is the case of the recent installation in the *Turecamo Boys*, the second Winton-Diesel towboat to be placed in service by the B. Turecamo Contracting Co., Brooklyn, N. Y. Designed by Merritt Demarest and built by Rice Bros. Shipyards, this 93-foot towboat is powered with a six-cylinder, Winton-Diesel engine developing 600 b.h.p. at 250 r.p.m.

Winton Engine Corporation, Cleveland, Ohio, U. S. A.



Symbol of Economy
and Dependability

IN Industrial SERVICE



For years Winton-Diesel engines have been supplying low-cost power to scores of industrial organizations located from coast to coast. These superior power units range in size from 45 h.p. to 1200 h.p. Winton engines are compact, highly-developed power plants. Their clean, quiet and dependable performance reflects precision workmanship and engineering skill of the highest order. Among recent interesting Winton-Diesel installations is the one at the plant of the U. S. Gypsum Company, Midland, California. This installation, which will supply economical power and light required in plant operation, consists of one eight-cylinder unit, as illustrated, developing 700 h.p., at 360 r.p.m., direct-connected to a 485 k.w. 450 volt, three-phase, 60-cycle alternator and a 10 k.w. exciter

IN Railroad SERVICE

WINTON-DIESEL ENGINES

Power the Famous

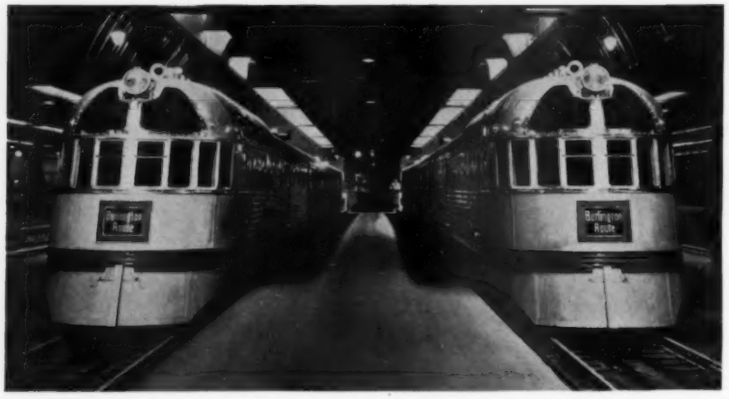
Zephyr Trains

The adaptation of the Diesel engine to mainline, high-speed railroad service was no mean achievement. Railroad executives demanded a more compact, lighter weight unit than had been heretofore available. This demand was answered by the development of the revolutionary, two-cycle Winton-Diesel engine that is now powering by far the largest majority of the high-speed streamlined trains in operation today.

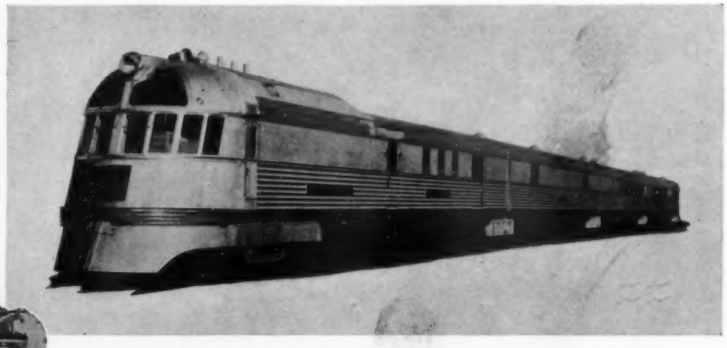
The first high-speed Winton-Diesel-powered train was the original Burlington *Zephyr*, powered by an eight-cylinder, two-cycle, 600 h.p. engine. This *Zephyr* train, operating on regular schedule between Kansas City and Omaha, holds the record for the longest and fastest non-stop run from Denver to Chicago, 1017 miles in 13 hours and 5 minutes, at an average speed of 78.7 m.p.h.

The second and third Diesel-powered Burlington units are the *Twin Zephyrs*, running on daily, round-trip schedule between Chicago and the Twin Cities. The fourth and latest addition to the now famous *Zephyr* family is the *Mark Twain Zephyr* operating between St. Louis and Burlington.

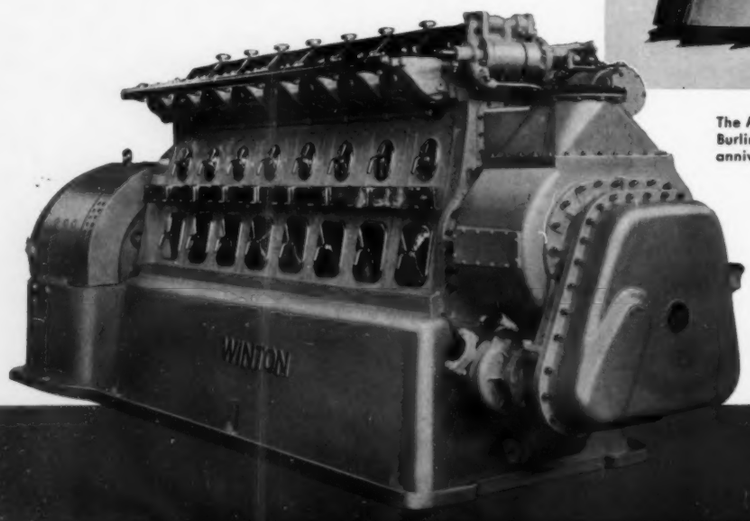
Each of these trains is powered with a 600 h.p., eight-cylinder, two-cycle Winton-Diesel engine.



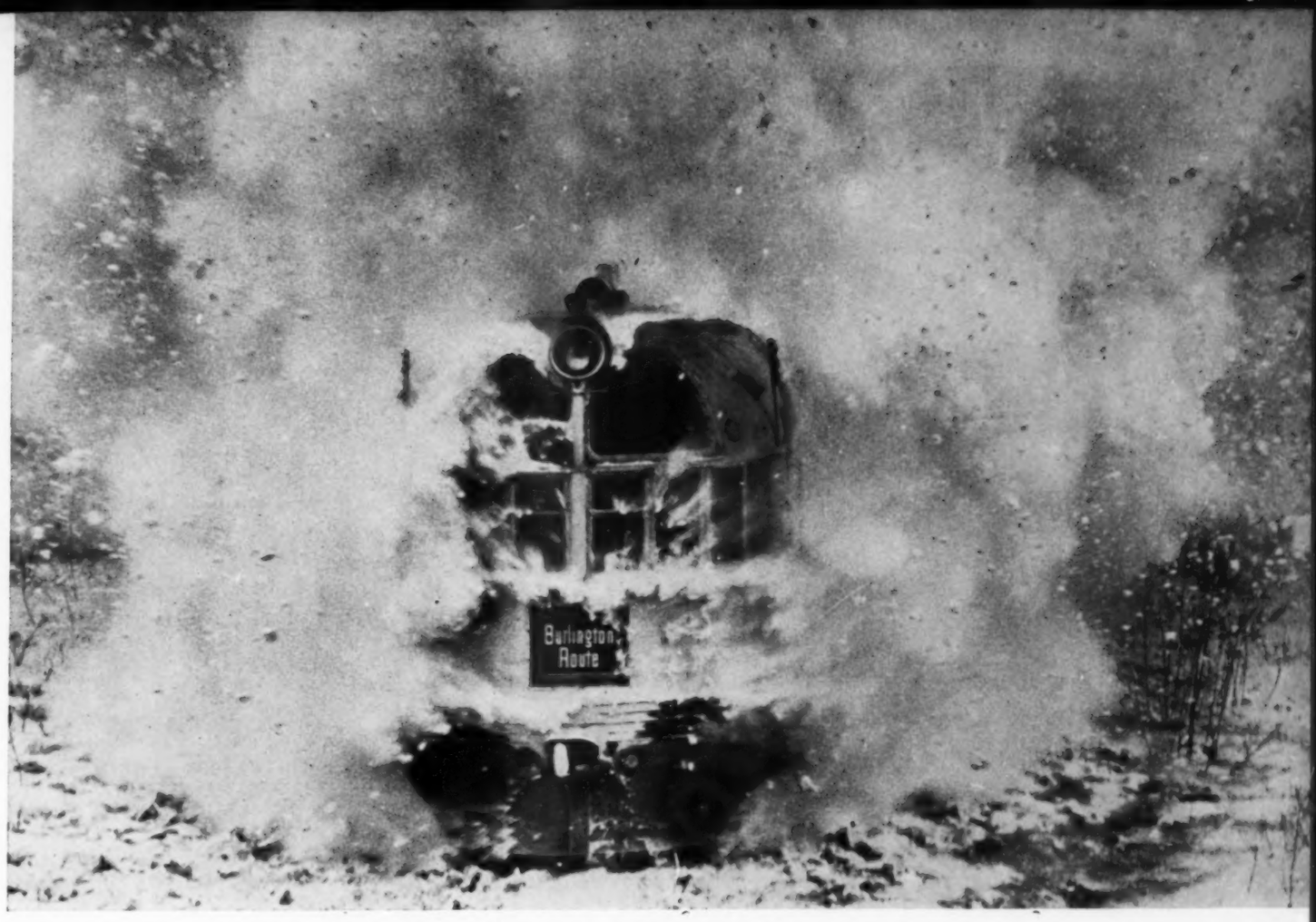
The Burlington *"Twins"*, operating daily between Chicago and St. Paul-Minneapolis, cover the 431 miles to St. Paul in 6½ hours at an average speed of 66 miles per hour



The *Mark Twain Zephyr*, a four-car unit running between St. Louis and Burlington, so named by the Burlington in commemorating the centennial anniversary of the famous humorist's birth. On early trips, this train attained the speed of 122 m.p.h.



Eight-cylinder, two-cycle 8" x 10", 600 h.p. Winton-Diesel engine installed in each of the high-speed, streamlined Burlington *Zephyr* trains



The "Zephyr" hits a snowbank. At 80 miles an hour the Burlington "Zephyr" plows through a snowbank near Lee, Ill. Despite such conditions, schedules were maintained.

F. G. GURLEY TALKS ON ZEPHYRS

On March 27th at Purdue University, Mr. F. G. Gurley of the Burlington System read an extremely timely paper from which quotations appear hereunder. Mr. Gurley is one of the outstanding "operations" men in the railroad kingdom today and on his broad shoulders rest the responsibilities of the operations of the whole Burlington Lines.

THE type of motive power best suited for railroad service has been and is a question on which opinions differ. This is true of any field where progress is made. In 1828 work was started on the first railroad in America. Horses had been used since the dawn of civilization and horses were used on this railroad, but certain progressive people, including Peter Cooper, thought that a steam engine might be better. He built a steam engine known as *Tom Thumb*, which did fairly well, but owners of a stage line challenged the supremacy of the new engine. There was a race between one of their best horses and the *Tom Thumb* in August, 1830. The horse won and horse drawn cars continued to be the only vehicle used the following year. By that time the development of the steam locomotive warranted its adoption. Steam has continued to furnish most of the motive power on the railroads of this country ever since.

At the time of the race the majority of men engaged in transportation were "horse minded" and I believe that today, generally speaking, railroad men are "steam minded," but, nevertheless, when another type of power made its appearance which gave promise of being better in at least some branches of railroad service the spirit of progress and improvement which caused the abandonment of the horse prompted a trial of the new motive power. I refer now to the Diesel engine.

It is appropriate to say at this point that I am not advocating the Diesel or any particular motive power. My objective as a railroad operating officer is to find the best type for railroad service, recognizing that probably no one class of motive power will satisfactorily meet the varied requirements of rail transportation.

The first commercial Diesel engine in the world to be put into regular service was built in St. Louis in 1898. This was a two-cylinder 60 hp. unit. The earlier Diesels were much too large and heavy for rail service. In 1925 the first sale of a four cycle Diesel-electric locomotive to a railroad in the United States occurred. That engine is still working in yard service. It weighed too much per horse power and developed insufficient total horse power to be suitable for high speed road service. There are now an appreciable number of Diesel-electric switch engines in the United States, although the total number is small when compared with the number of steam switch engines.

The Burlington uses three 450 hp. four-cycle Diesel-electric switchers. The first of these engines was placed in service in May, 1934, and the other two a few months later. They are assigned to service 24 hours per day, six days per week and 16 hours on the seventh day. Thus eight hours per week are allowed for maintenance.

The cost per switch engine hour, exclusive of the wages of switchmen, as compared with the steam locomotive replaced, is as follows:

	Steam	*450 hp. Diesel*	
Fuel	$1.438	$ .229	
Repairs – running	.696	.36	
– general	.180	–	
Wages – enginemen	1.63	.92	(no fireman)
Lubricating oil	.015	.078	
Water	.11	–	
Enginehouse expense	.10	.054	
Depreciation	.046	.363	
	$4.215	$2.004	

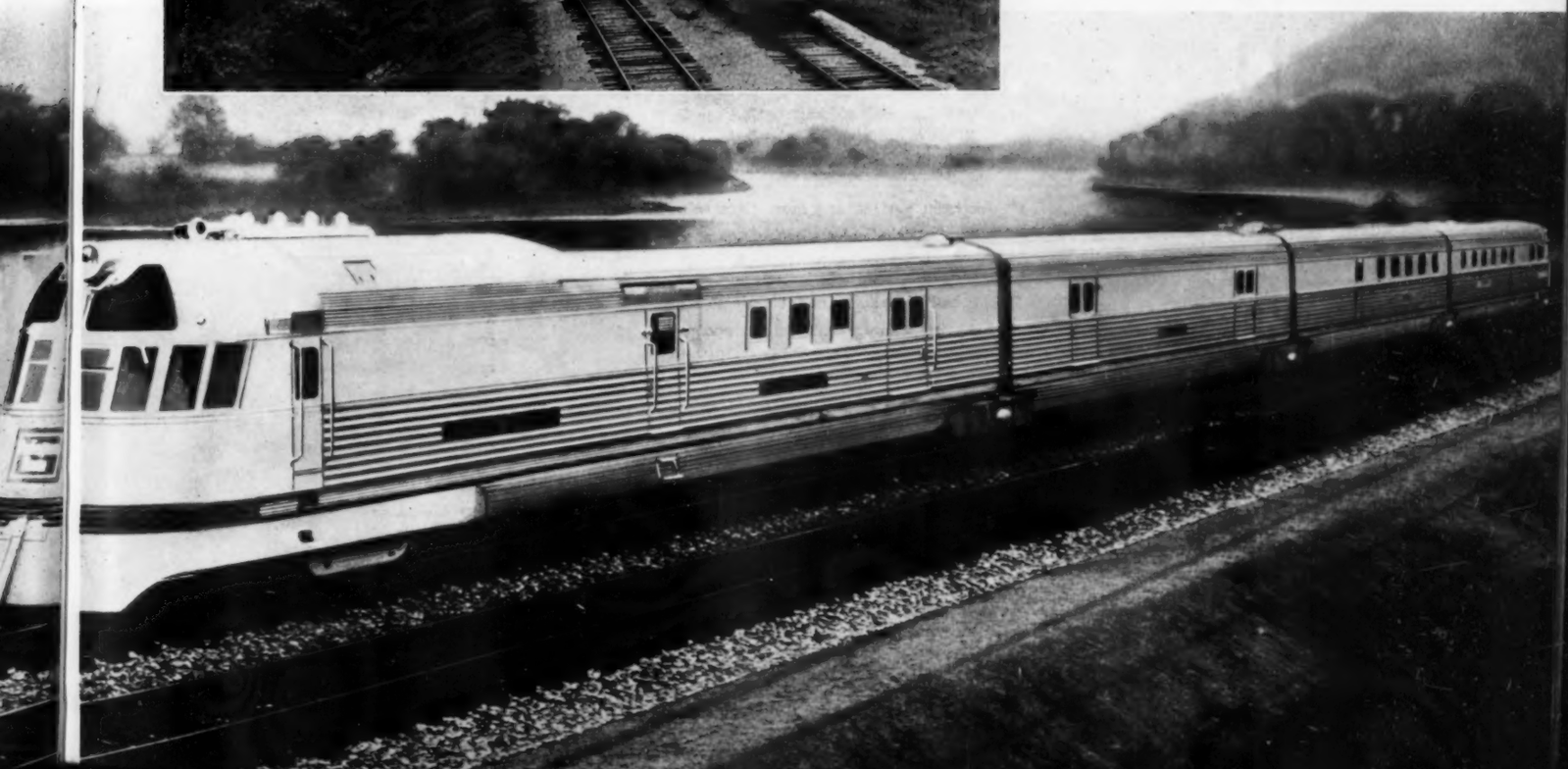
In this statement depreciation has been set up as 4 per cent on the steam engine and 8 per cent on the Diesel. Observe that the charge per engine hour for depreciation is almost 32 cents more for the Diesel – yet the hourly saving is $2.21. There are 8,760 hours per year. Our experience is that we may reasonably anticipate keeping the Diesel-electric engine in service at least 85 per cent of the time, or 7,446 hours of service per year. My opinion is that the rate of depreciation on a Diesel should not be twice what it is on a steam switch engine.

The economies obtained and the experiences with these small switchers has resulted in our placing with the company which furnished these three an order for a larger four-cycle engine developing 1,000 hp. at 1,000 rpm. When received it will be used in combination yard and branch line road work on one of the Texas Lines. This locomotive will be of the same general construction as the first three; utilizing two 12-cylinder "V" type engines.

The Burlington has had less experience with Diesel-electric switch engines than have some other railroads and I believe the intention is that I devote most of my time this afternoon to high speed passenger service.

Before I speak about Diesel-electric locomotives in road service I desire to tell you something about our gas-electric operations. Several years ago we found that money could be saved by replacing many branch line and some main line steam passenger trains with gas-electric cars. It is my understanding that we use more gas-electric cars than any other American railroad, operating about three million gas-electric motor car miles per year. Our costs per mile, exclusive of crew and carrying charges, on a five-year average have been:

Some random "shots" of the four Burlington Diesel streamlined "Zephyrs" in action which have been making and sustaining such remarkable records in railroad passenger service since November 11, 1934, when the first unit was placed on its regular scheduled run.



Maintenance (both running and general) including gasoline engine, electrical equipment, truck, and carbody	5.58c
Fuel and lubricating oil	5.23c
Total	10.81c

I did not occupy my present position when we started to operate our gas-electric cars, and because I had nothing to do with it I feel free to say that our management perfected a fine organization for the operation and maintenance of these internal combustion engines. With this splendid organization and the background of successful experience with gasoline engines, we were on the lookout for a lightweight Diesel engine for high speed road service if one could be produced.

While two-cycle Diesel engines developing approximately twice the power of a four-cycle from a cylinder of the same size were built over thirty years ago, they like the four-cycle were of dimensions, weight, and speed which made them impracticable for high speed locomotives. An engine of relatively high revolutions per minute is necessary in order to secure lighter weight electrical equipment as well as lightweight Diesel engine equipment.

It was early in 1933 that we definitely decided to build a small streamline train. This later became known as the *Zephyr*. For such a train a lightweight internal combustion engine is an absolute essential. A new type two-cycle lightweight Diesel had just been developed and after an investigation we were willing and anxious to use it. Its dimensions were almost ideal for our purpose. This engine is an eight in line, 8″ x 10″ cylinders, developing a maximum of 660 hp. at 750 rpm. Our four-cycle gasoline engines with 8 cylinders 8″ x 10″ develop 400 hp. at 950 rpm. and weigh 31 pounds per horsepower. The two-cycle Diesel weighs 20 pounds per horsepower. Improved materials helped substantially in accomplishing this desirable reduction.

The original *Zephyr*, America's first Diesel powered streamline train, is powered by the first two-cycle Diesel engine placed in rail service. Only three like it had been made before — the first never left the laboratory, and the other two were used in exhibition service at the 1933 Century of Progress.

This engine made its initial trial run April 9th, 1934, and had an interesting pre-service career. It made a triumphal tour of the United States, including a non-stop run of 1,015 miles from Denver to Chicago at an average speed of 77.6 miles per hour.

The original *Zephyr* started on its assignment between Lincoln, Neb., and Kansas City, Mo., via Omaha, Neb., November 11th, 1934. Up to March 1st, 1936, the latest date for which complete records are available, that train and its companions, the two *Twin City Zephyrs* and the *Mark Twain Zephyr*, have made 838,882 miles. On that date Diesel powered streamlined trains on all other American railroads had operated 622,860 miles. The availability of all of our *Zephyr* Diesel-electric trains since placed in service up to March 1st was 97 per cent. The availability of the engines would have been higher had it not been necessary on a few occasions to take the trains out of service for other reasons. All of our Diesels are in articulated trains. The assigned mileage of these four Diesel trains is 987,690 miles per year.

Professor Jacklin of Purdue University, apparently prompted by his own experience with new equipment, requested me to mention some of the things that have gone wrong. Before doing so let me make the general observation that in the development stage of any mechanical engine or appliance, no matter how sound, obstacles arise and difficulties must be overcome. Every effort is made to anticipate troubles and to reduce them by making adequate preparations. As other problems arise, they must be met.

To be specific, it is impossible to maintain two Diesel-electric units in operation with facilities and by an organization developed to care for steam engines and expect each unit to make 26,460 miles a month as we do between Chicago and Minneapolis. Each of the *Twin City Zephyrs* makes a round trip each day between Minneapolis and Chicago. Prior to inaugurating our *Zephyrs* we trained our personnel in Diesel-electric locomotive maintenance and provided the facilities needed for expeditious and accurate work.

We had troubles with our gas-electric cars when we first received them. Our Diesels have not been perfect, any more than other motive power. Periodical staff meetings are still held to discuss steam engine failures.

We had difficulty with fuel injectors due to air leaks in packing and connections which produced some irregularity in the injector resulting in an air lock in the fuel oil line. This was corrected by a return line which kept the air moving and did not permit an air lock. We have experienced difficulty with pistons, valves, and cylinder heads, but not to the extent that we encountered years ago with the gas-electric cars. These troubles we overcame, and the changes made in our Diesels have all been steps in the desired direction; i.e., solution of these problems.

We have had four instances of trouble with traction motors. One of these was due to improper lubrication and resulted in a change in our policy with reference to grease application. Two apparently were roller bearing failures. This caused us to adopt a different system of inspecting traction motors. The plan now is to remove and make careful inspection each 150,000 miles. The fourth was directly traceable to a man failure on the part of our maintenance force during February when, at one time two of the regular men were off sick, and the remaining force just did not get around to all the things that required attention.

A field coil burned out of a main generator of the original *Zephyr* due to snow getting into the generator causing a "flash over." A side door of the engine room inadvertently came open, and this permitted the snow to get into the engine room. This is the first and only experience we have had of that kind with either our gas-electric or our Diesel-electric trains.

Despite the heavier pressure of a Diesel as compared with a gasoline engine we have had absolutely no trouble with main crank shaft or connecting rod bearings.

During the recent severe cold weather our Diesels gave a splendid account of themselves — in fact did better than any other trains we operated.

The two engines assigned to daily round trips between Chicago and the Twin Cities operate at an overall speed between Chicago and St. Paul terminals of 66.3 miles per hour and make 2.9 train miles per gallon of fuel oil hauling a total of three units. This is the fastest schedule in the United States on runs in excess of 100 miles. The other two pull four units each on a somewhat slower schedule, one makes 2.4 train miles per gallon, the other 1.9. The present purchase price of fuel is 3.49c per gallon.

The costs per train mile for locomotive maintenance, fuel and lubricating oil since the four engines were placed in regular service up to February 1st, 1936, have been:

	Cents
Locomotive maintenance, including Diesel engine, electrical equipment, power truck (one) and other equipment in engine compartment	2.62
Fuel oil	1.39
Lubricating oil	.83
Total	4.84

The Twin City trains did not replace any steam mileage but in Missouri where the reverse is true comparative costs were:

	Cents
Locomotive maintenance — running	10.21
— general	5.00
Fuel	13.77
Lubricating oil	*Negligible*
Total	28.98

The steam costs, as locomotive builders point out in similar cases, are for engines over 20 years old, and which pulled a heavier load, but nevertheless they are the actual figures. It is also true that the Diesel costs do not include any general repairs, which constituted 5 cents or 33 per cent of the steam locomotive costs.

In approaching the problem of purchasing new motive power in the medium or upper brackets of horsepower for long distance high speed passenger work and in deciding whether it shall be steam or Diesel the answer is not so readily apparent as in the case of the small three-car train. The purchase price of a Diesel is considerably more than for a steam engine of corresponding power. This is quite a handicap for the Diesel. Maintenance costs for either locomotive in such service are somewhat speculative. We have the background of steam costs in comparable sizes, but in heavier and lower speed work, and the knowledge of Diesel costs in high speed but lightweight assignment for a comparatively short period, augmented by experience with gas-electric engines over a considerable period of time.

What are some of the things which may be listed definitely in favor of the Diesel? Let us examine first the question of "making the time."

Often the statement is made that a steam engine will run as fast as track conditions, city ordinances, grade crossings, and similar things will permit, and further that it can run as fast as the Diesel. I think that is all true, but that ability is not the vital consideration. In operating a train on any schedule, and especially a very fast one, it is quite desirable to hold the maximum speed as near the average as possible. This is worthy of emphasis. In this regard the Diesel has an advantage over the steam engine. This is true because among other things:

(1) The Diesel can make longer runs without change of locomotives, thus saving the time required to uncouple one engine and couple on another.

(2) Less time is needed for refueling and water enroute.

(3) If coal is burned on steam engine fire and ash pan cleaning will be necessary.

(4) Less time is required to slow down or stop, because the rate of deceleration is faster than with existing steam engines. This is possible by reason of a higher braking ratio. A high braking ratio on steam locomotive drivers, the tires of which are shrunk on and held in place by the force of contraction would develop a dangerous degree of heat.

(5) Acceleration: With the same maximum horsepower and trains of equal weight, the Diesel-electric will reach a speed of 90 miles an hour quicker than a steam engine. But the characteristics of the steam engine allow opportunity for it to be designed with sufficient reserve horsepower so that it is probably fair to say that in actual practice each engine should attain top speed in about the same time.

The time saved by any one item may not appear large but the cumulative effect will be appreciable, and the time thus saved may be so distributed that no speed bursts are required, but instead the train will maintain a sustained cruising speed as close as possible to the average speed — thus insuring greater comfort. It is surprising how valuable minutes become on a fast schedule. In fact a minute under such circumstances may be capitalized for a greater amount than would be possible with a slower schedule.

What about continuity of service and availability? How many miles per day and per year can be made by the two types of locomotives? If one can do substantially better than the other, then the question is not so much the purchase price per unit, but purchase price per locomotive mile. In other words, will one steam locomotive equal in productivity one of the higher priced Diesel-electrics?

My understanding is that the record for a steam engine in regular passenger service in any single month is 19,200 miles. This record was established in 1934 by an engine built in 1931, when operating on an engine district of 914 miles, at an average speed of 41.5 miles per hour. The highest average miles per month however is much below that. Under the plan in effect when that record was made the engine received intermediate service at twelve stations; water being taken nine times and coal five; the fire was cleaned twice and ash pan was dumped five times, and pins lubricated five times. When the schedule is speeded up to an average that is about 60 per cent faster, such as we have now between Chicago and the Twin Cities, and propose between Chicago and Denver, an entirely different situation is created. Then it is that delays incidental to refueling, water, fire cleaning, etc., assume real proportions. On one nationally known passenger run operating between 950 and 1,000 miles at an average speed of 58 miles per hour three steam engines are used each trip.

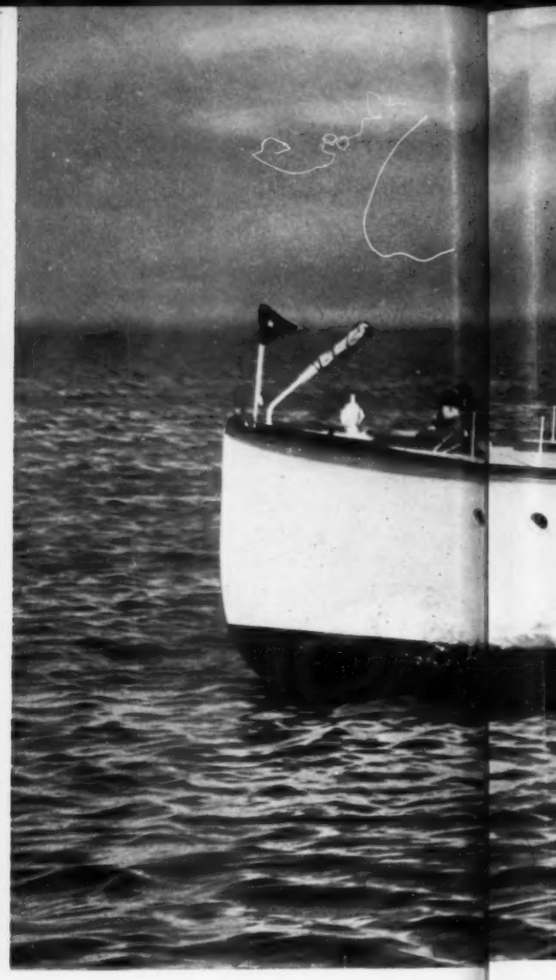
Some locomotive assignments have a high test or laboratory value, perhaps none more than our Chicago-Twin City Diesel-electric assignment and the steam assignments on other lines. We have been making a round trip daily, the others a single trip. This experience definitely supports the conclusion that one steam engine is not the equal of one Diesel-electric in productivity.

On the Burlington we have had the benefit of another very interesting experience on a part of the railroad where new high speed trains are to be inaugurated, the results of which influenced the decision I shall mention later. For the two and one-half years ended May, 1835, one of our fine Hudson type engines had a daily assignment of 510 miles, making a round trip each day between Denver and McCook on our *Aristocrat*, which on its eastward schedule had an average speed which varied from 43.5 to 46.1 miles per hour. During this period the availability of that engine was 69.21 per cent. (In the sixteen months from November, 1934, to March, 1936, the original *Zephyr* with a daily assignment of 500 miles had an availability of 96.11 per cent.)

The steam engine was given "general shopping" three times in that two and one-half years. Each time a complete set of flues and a back flue sheet were renewed on account of the pitting action of water in that territory. At two of the shoppings portions of fire box side sheets were renewed for the same reason.

Many things contribute to the greater availability of the Diesel-electric. Compliance with governmental inspection requirements will keep a steam engine out of service fifteen days per year. Diesel-electric inspections can be made during layover periods. Moving parts of the Diesel engines are of a nature and weight which permit normal running repairs to be made during layover periods if there are about seven hours at mechanical terminal between the arrival and departure. Unfortunately that is not true of a steam engine.

. . . . *And now please turn to page 50*



Main living saloon looking aft. Above: A corner of the bar and view into the owner's stateroom. N.B. — These illustrations portray a custom 48' motor yacht. Changes in the design of the "Chimaera" are fully described in the text.

CHIMAERA

Twin Diesel 48-Foot Elco Cruiser

"AHOY! What boat is that?" "Diesel Yacht *Chimaera* from Bar Harbor!" Hails such as this will be heard more and more along the entire seaboard of the United States and inland waterways and mark a definite beginning to a new era in American yachting.

The rapid strides of Diesel engine builders during the last few years toward perfecting this type of motor for use in the smaller sized pleasure craft are being amply justified by a remarkable acceptance among owners. Purchasers of standardized cruisers are specifying Diesels for safe, dependable and economical power.

Such is the case of the latest addition to the Elco fleet, the *Chimaera*. This new forty-eight-foot, custom designed cruiser will be ready for delivery soon after May 1st to Mr. A. E. Archbold of New York with Bar Harbor, Me., as her hailing port. A few slight changes were made at the owner's request from the standard Elco design for this type vessel but when the subject of powering arose, Mr. Archbold specified Diesels.

At the present time practically every builder of stock cruisers offers Diesel propulsion as optional and discriminating yachtsmen such as Mr. Archbold are enthusiastically accepting this opportunity in ever increasing numbers.

The *Chimaera* truly embodies the many diverse features necessary to insure owner satisfaction and builder pride. Her graceful and pleasing appearance has been achieved without sacrifice of seaworthiness or convenience; desirable cruising speed is compatible with good operat- . . . . *And now please turn to page 54*

DIESEL COLD STORAGE WAREHOUSE

By E. SCHOONMAKER

THE experience of the Hall Street Cold Storage Company with Diesels, dating back several years, when their capacity was less and their building much smaller that it is now, prompted the installation of additional equipment. Early in 1930 the first Fairbanks-Morse Diesel was installed to operate a 30-ton York 9″ x 9″ compressor, through a direct connected drive – to replace an electric motor operating on purchased power. The engine assumed a terrific responsibility, running twenty-four hours daily, except for an hourly shutdown bimonthly to change the lubricating oil. The elimination of the purchased power charge for the electric motor and operation of the engine on inexpensive fuel oil, cut power cost to such an extent that plans were made to enlarge storage space, put in more Diesel equipment and prepare to handle the storage of meat, fruits and vegetables on a more profitable basis.

During the depression years, 1933-1934, two stories were added to this 40-year-old building, which, for more than half of its existence, was used as a packing house. When this was finished, the management of the Hall Street Cold Storage Company went to work on their power problem, with just one thought – reduced power costs – bigger profits.

Before the 1934 Summer season started, the one remaining electric motor, driving a 50-ton Frick 10″ x 10″ compressor, was taken out of service and replaced with a Fairbanks-Morse two-cylinder, heavy duty, 140 hp. Diesel engine. As the building had been enlarged, more refrigeration was needed, so another Diesel engine and compressor were added similar to the above unit.

A trip through the engine room today and a talk with Mr. E. Wiberg, chief engineer, who has been operating stationary and marine Diesel engines for the past twenty years, will convince you, without doubt, that for so little space required the Diesel engines installed pay big power dividends. These two 140 hp. Diesels, direct connected to ammonia compressors, driving F-M 63 kva. alternators, mounted above each engine and driven by F-M Flex Mor "V" belts from the fly wheels, were installed in what once was an old smoke house, measuring 16 x 20 feet.

The alternators dispensed with the need for outside power. However, to play safe, a 10 kw. breakdown service was provided by the local utility company for lights and emergency operation of the plant. As this was not used once through 1934, the standby utility service was eliminated. The plant operated through 1935 and continues today to depend ENTIRELY on Diesel generated power.

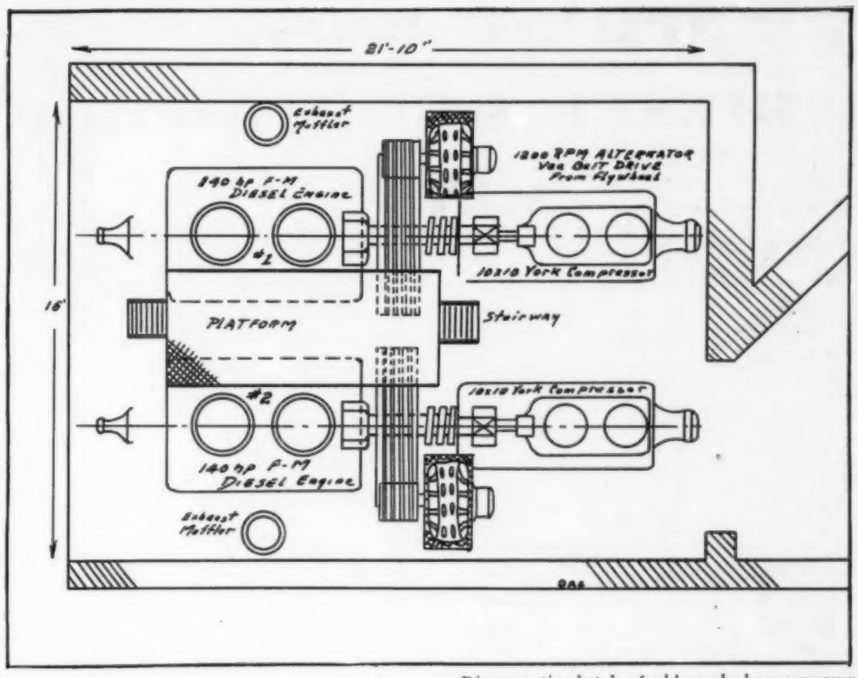
Upon entering the engine room, one is imme-

diately impressed – there is no vibration and each engine is equipped with Maxim silencers. In no part of the building is it evident that power is generated with engine equipment in the basement.

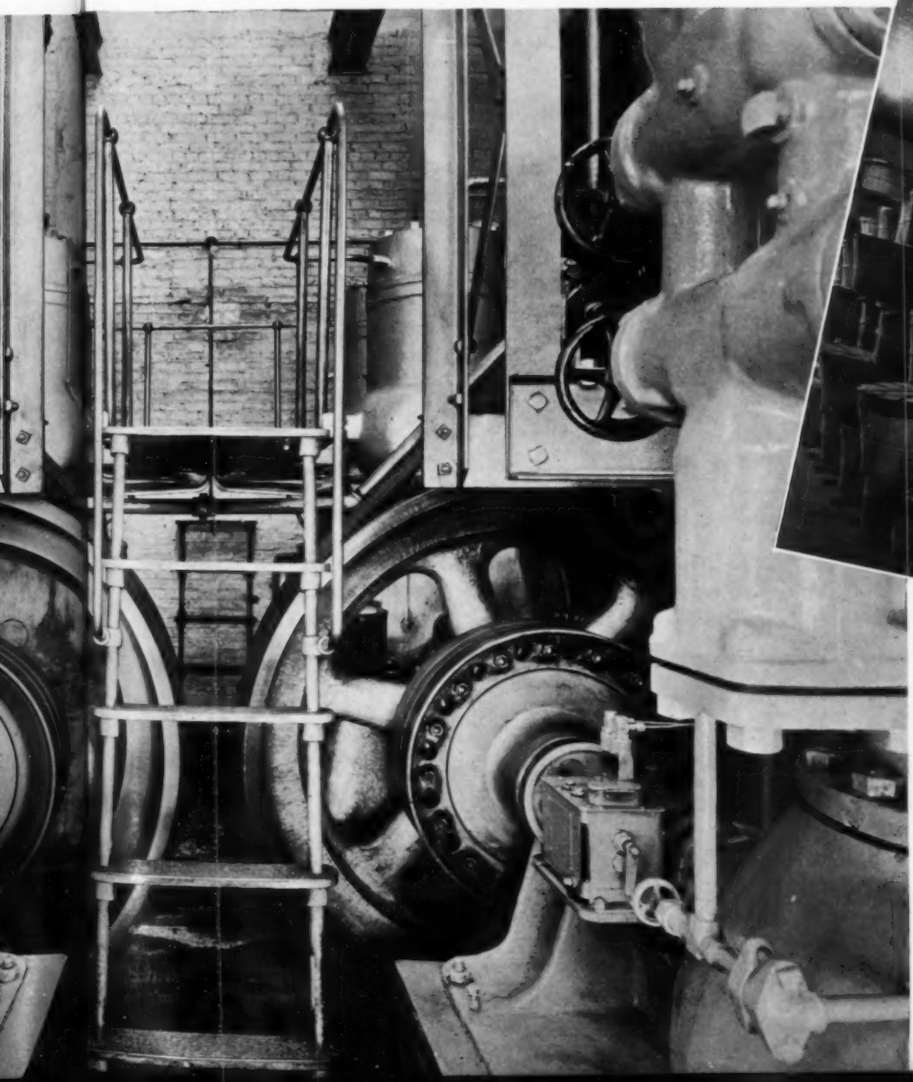
The summer time schedule from June 1 to October 1 keeps the three F-M Diesels operating 24 hours daily, except for an hourly shutdown every two weeks, which is staggered so as to have only one engine out of service at a time. The purpose of this is to change the lubricating oil and examine the engine which has been running steadily without stop for a period of 336 hours. During the winter season, October 1 to May 31, one of the engines operates 24 hours a day – the other two are standbys – operation is alternated between the two larger engines at weekly intervals, while the older 60 hp. engine remains idle.

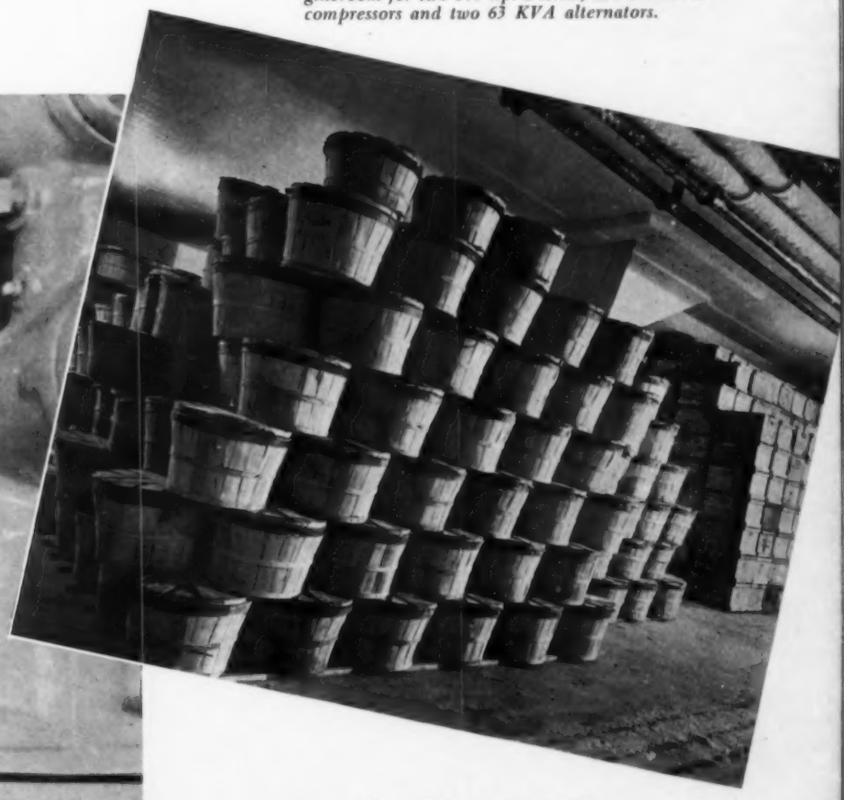
With such steady running it is reasonable to expect some wear. However, the engineers' record shows the maintenance cost to date to be nil so far as the two large engines are concerned, and only $150.00 on the 60 hp., which has been running since 1930, or about $25.00 a year for maintenance, covering small replace-

. . . . *And now please turn to page 62*



Diagramatic sketch of old smoke-house measuring 16 by 21 feet which now serves as the engineroom for two 140 hp. Diesels, two ammonia compressors and two 63 KVA alternators.



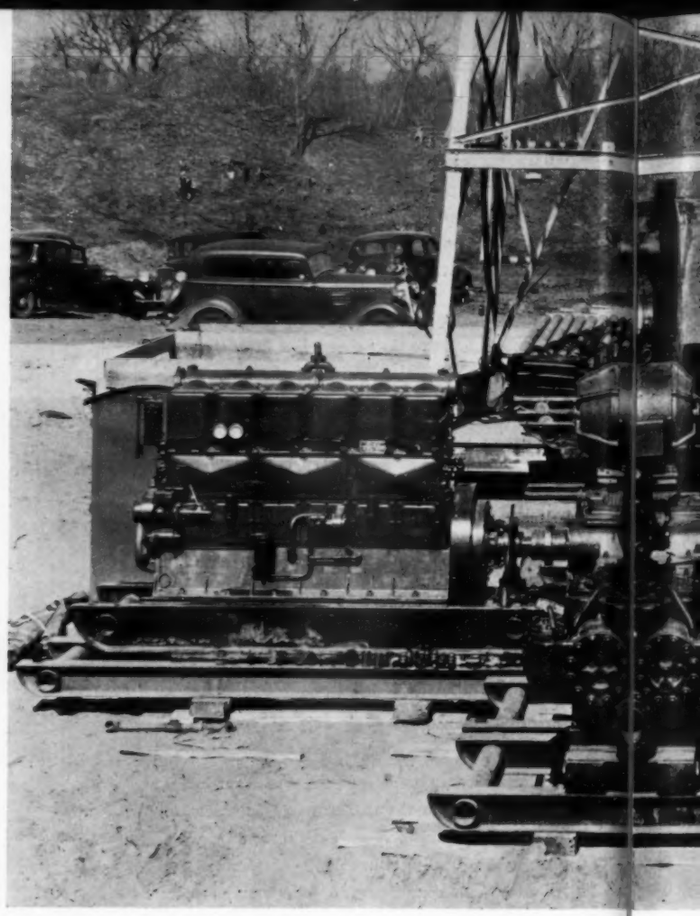


Left: The loading platform of the Hall Street Cold Storage Warehouse.

Center: Interior of the converted smoke-house, showing the extremely compact machinery installation.

Right: A corner of one of the eighteen cold storage rooms and some of the produce being held for market.

SPRING ROSE DIESEL DRILLING RIG



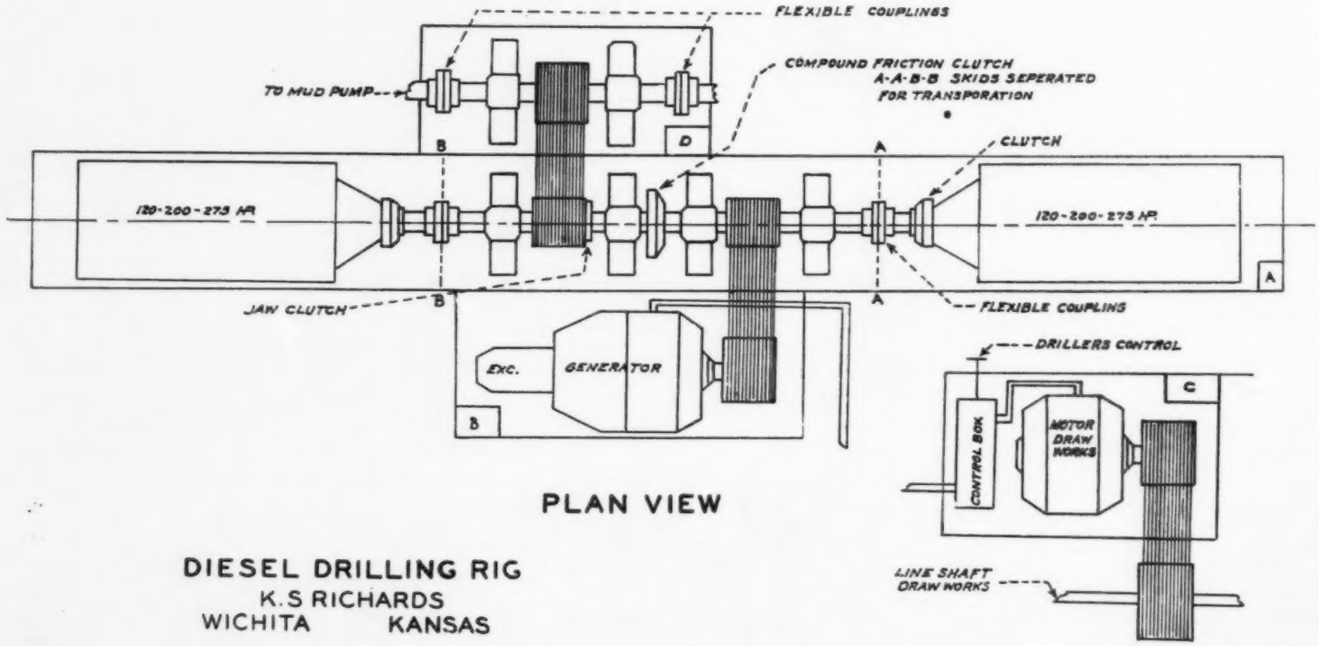
Broadside view of the Atlas Diesel drilling rig on location at a well. Below — Plan view of rig showing disposition of component units.

FOR simplicity, flexibility and efficiency, the recently installed Diesel rig of the Spring Rose Drilling Company, Wichita, Kan., takes the field against all competition. It differs from many other Diesel drilling units in that the slush pumps are mechanically connected to the engines and the drawworks are operated electrically. As clearly indicated in the accompanying diagram, the Diesels are opposed to each other and coupled to a common line shaft from which power for both drives is drawn.

This double system of transmission has two main advantages: The direct, mechanical drive to the pumps eliminates all electrical losses from generators, motors and transmission lines; and makes available the high efficiency of V belt drive. The electrically driven drawworks admits the unparalleled flexibility of speed and torque control of variable voltage, direct current operation. Thus both engines can be compounded through the medium of the generator for hoisting with the drawworks motor.

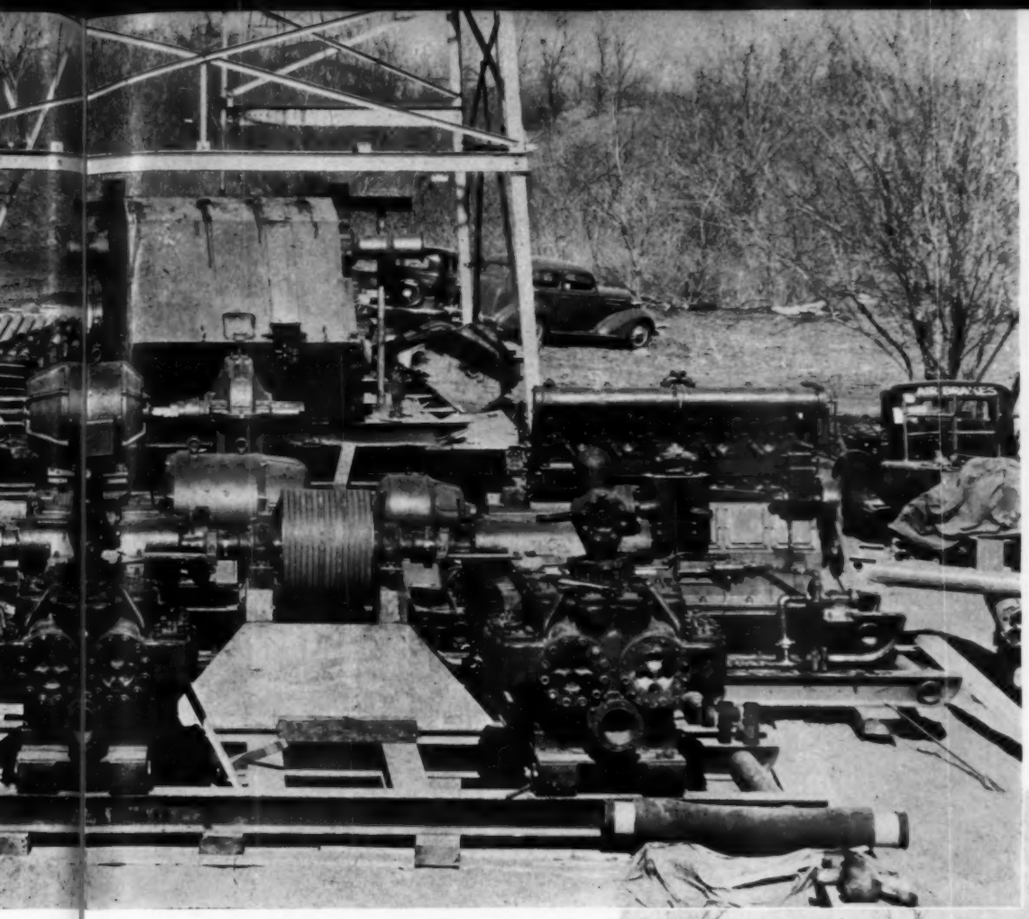
By this simple but effective arrangement it is therefore possible to employ two duplicate Diesel engines for proper standby service, each large enough to handle the major pump load alone, and still when operated simultaneously, power for the lighter load of actual drilling is delivered without the necessity of running one engine inefficiently at only a fraction of its rated output.

The two engines used are six-cylinder Atlas Diesels rated at 200 hp. at 514 rpm. with a bore and stroke of nine inches by ten and a half inches respectively. The generator rating is



PLAN VIEW

DIESEL DRILLING RIG
K.S RICHARDS
WICHITA KANSAS



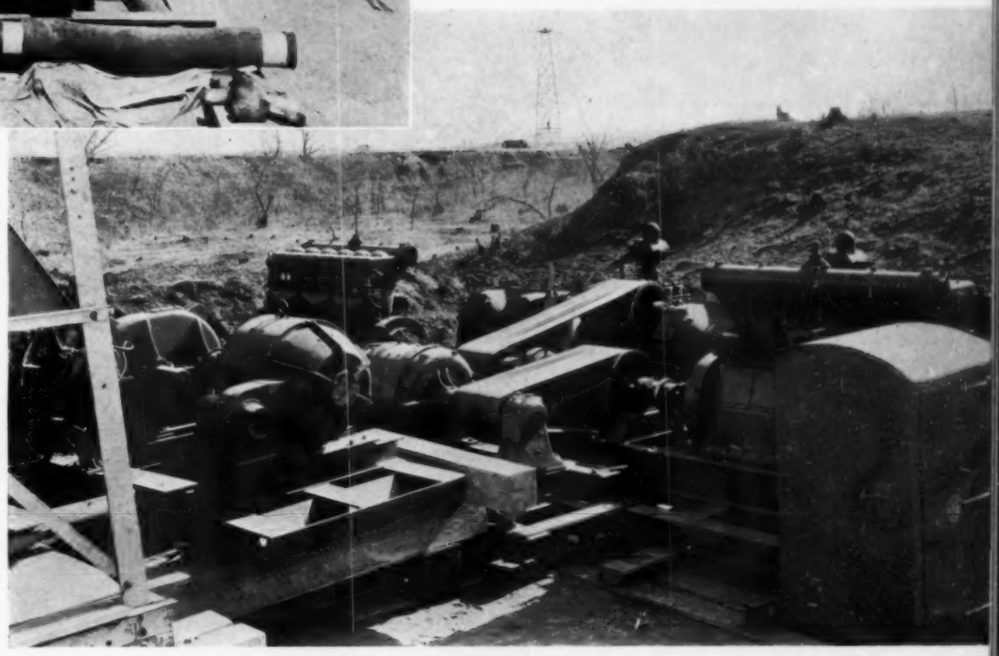
works motor, however, is determined entirely by the polarity and voltage of the generator which are determined by the operator to suit specific conditions. At such time as the total load exceeds the capacity of one engine, it is obviously a simple matter to throw the second onto the line so that at no time is it necessary for these Diesels to be operating inefficiently at other than their rated capacities.

During periods when hoisting is required, the pump is stopped and, if the load is sufficient, both engines are compounded through the generator. Hoisting speed depends entirely upon keeping the Diesels properly loaded during this operation. It is the responsibility of the driller to regulate this load by watching the ammeter and adjusting the voltage so that the current utilized by the driving motor is held at the point where the generator output is a maximum. It is readily apparent that if

250 kw., 350 volts at 1,200 rpm. The motor operating the drawworks supplies 300 hp. at 350 volts and 1,000 rpm. and is an enclosed type necessitating artificial ventilation. To furnish this a small motor blower is attached which maintains a constant interior temperature. A chain drive and geared speed reducer transmit power to the drawworks.

Both engines are connected to the central shaft through Twin Disc clutches and flexible couplings with an additional clutch between the two V belt sheaves. Thus, one transmission drives the slush pump shaft and the other the generator. The drive to the former can be disconnected from the main line shaft at any time by simply disengaging an over-running jaw clutch.

The three units, the two Diesels and line shaft assembly, are individually mounted on H beam skids which are in turn bolted together and secured to a common steel sub-base. This insures a rigid and solid installation without the use of concrete which is of major importance in facilitating setting up and dismantling the power station on the field. The total weight of the unit assembled is 30,600 pounds approximately 90 per cent of which is contributed by the two Diesels. The electrical hook-up is conventional barring the addition of a voltage regulator which is not usually found on this type of rig.



Quarter view of the rig looking from the derrick.

A few words concerning actual operation will indicate very clearly the previously mentioned advantages of this drilling unit. When starting a new well or at any other time when the load required is light, one of the two Diesels assumes the load for both pump and drawworks with the second engine idle. The speed ratios of both of the above drives are such that both operate at normal when the Diesel or Diesels are running at full capacity. The direction of rotation and speed of the drawless than this amount of current is being used a higher drawworks speed is available. It is impossible to impose a dangerous overload on either the generator or the engines due to the differential field winding of the generator.

The "Spring Rose" drilling rig exemplifies one of the most ideal utilizations of Diesel engines in the oil drilling service and its successful operation is ample justification for the time and study attendant to its development.

DIESEL WORK BOAT "PHILLIPS"

By W. L. O'DONNELL,
U. S. Associate Engineer

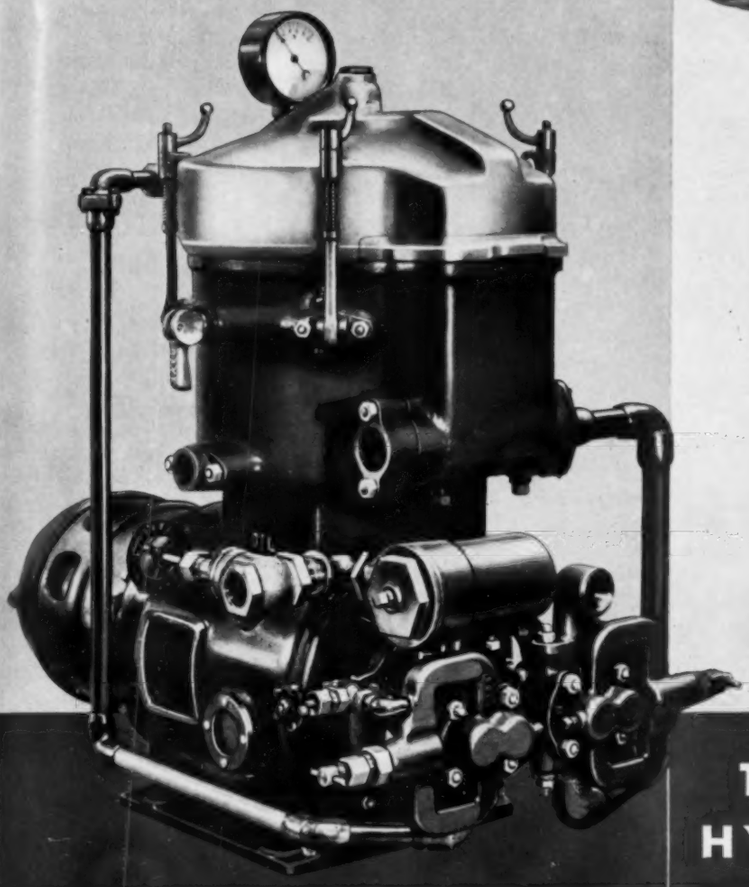
THE Diesel boat *Phillips*, recently completed and placed in commission by U. S. Engineer Department, Vicksburg, Miss., was designed by the Office of the President, Mississippi River Commission, and represents a unique shallow draft type boat, without the use of tunnels for use on western rivers. This boat utilizes the latest design of light weight, non-reversing, electric starting Diesel engine.

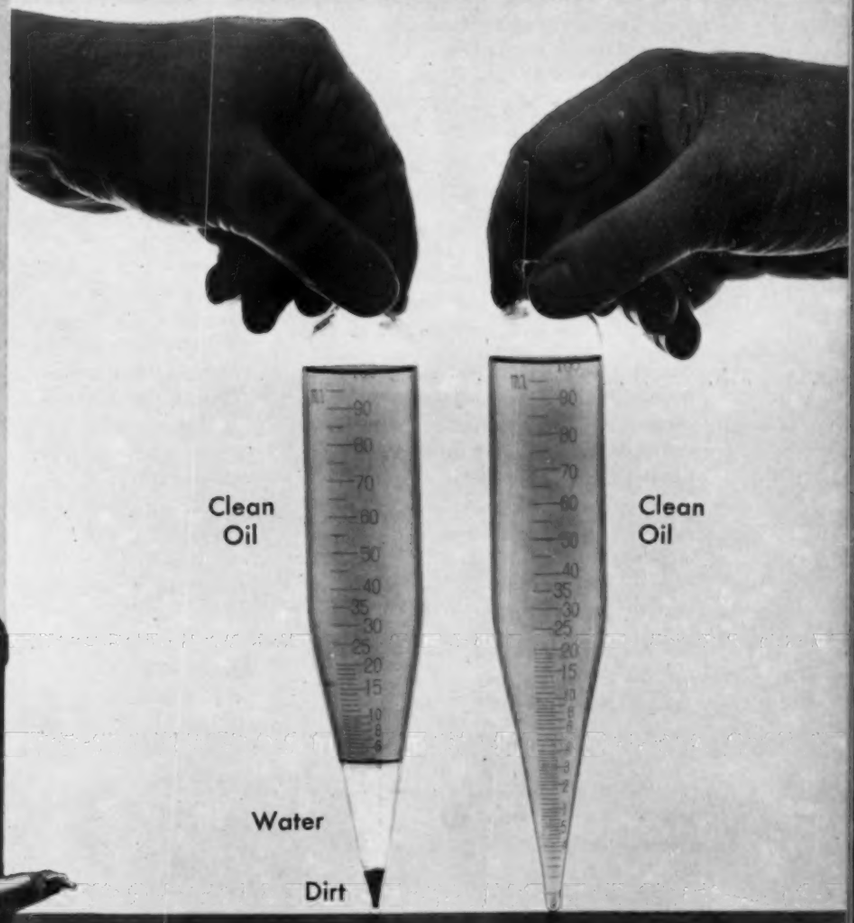
The boat has been named for Mr. O. K. Phillips, Jr., of Rockdale, Texas, who lost his life by drowning, in line of duty.

. . . . *And now please turn to page 48*

The only safe oil is clean oil

This unretouched photograph shows *"whizzed" samples of used oil before (left) and after (right) purification in a Goulds Hydroil Centrifugal Purifier.





THE *"WHIZZER" PROVES HYDROILIZED OIL IS CLEAN

I'm SLUDGE *the menace*

"I hate Hydroils. They go round and round until I get dizzy, then they throw me right out of the oil and I can't get back in again. I hate Hydroils."

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WHIRLING at high speed the "*whizzer" builds up a centrifugal force thousands of times greater than gravity—proves that oils, purified by a Goulds Hydroil Centrifugal Purifier, are brought back after use to the same clean, pure condition as originally furnished by the leading refiners. Hydroilized lubricating oils contain no grit, carbon or other abrasive materials that score bearings, shafts and compressors. Elimination of sludge and water does away with plugged oil lines and assures adequate lubrication at all times. Hydroilized fuel oil contains no dirt, sand or water that wears fuel pumps and nozzles—causes injection troubles.

In either continuous or batch operation a Goulds Hydroil maintains oil at the high efficiency necessary for non-stop Diesel operation and makes frequent oil changes or rest periods unnecessary.

*Special High Speed Laboratory Centrifuge for Testing Oil Samples.

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DIESEL WORKBOAT *PHILLIPS*

. . . . *Continued from page 46* . . . .

An average speed of 10.79 miles per hour was obtained during the trial runs, with a draft of approximately 3′ 9″. The principal dimensions of this boat are: length overall, 42′ 6″; beam, molded, 11′ 0″; depth, molded 4′ 3″; draft, forward, 2′ 6″; draft, aft, 3′ 9″.

The *Phillips* is very trim in appearance, utilizing the standard District color scheme of black hull, gray deck, lower half of the cabin gray, the upper half white. A neat streamline stack painted black with a red band, houses the muffler, and adds to the appearance of the boat.

The hull is of steel, riveted and welded construction, in accordance with the requirements of the American Bureau of Shipping. The design includes a modified scow type bow, a slightly modified bottom, square bilges, and three transverse watertight bulkheads. The stern is of the cut-away type, with skag and propeller fitted in the recessed portions, thus reducing draft without sacrifice to wheel diameter.

The bow is fitted with two steel towing knees, with oak fenders and size No. 1 hand type capstan, as manufactured by the Marine Manufacturing & Supply Company. A double bitt, the necessary kevels and chocks, are located on the forward deck for use in making up tow, all of which are cast steel construction, riveted and welded to heavy steel doublers on the deck. Ample deck fittings of similar design are provided on the stern and along the sides of the boat. The cabin is constructed of steel with wood windows and doors, with the pilot house on the forward end of the cabin elevated so as to give clear vision, both forward and aft. This boat being only for tender service in connection with a larger outfit, no quarters are provided on it for the crew. A unique feature of the cabin is that the roof is made portable in order that should it ever become necessary to remove the power plant or other machinery for repairs it can be removed out through the roof in one piece, by removing the portable roof and lifting it out with a crane. The main engine room floor is of the diamond pattern safety tread steel plate, and is made in removable sections to facilitate the cleaning of the bilges. Steps from the main engine room are of the steel tread type construction and lead to the stern of the boat and to the pilot house.

Machinery

This boat is powered with a Buda Lanova full Diesel motor of 6-cylinder, 4-cycle solid injection, non-reversing type, and 5¼″ bore by 7″ stroke, developing 127 hp. at 1,090 rpm. This 6-cylinder light weight unit shows practically no vibration in the boat, and is especially smooth over the entire speed range. The cylinders of this engine being equipped with removable cylinder liners lends to quick and economical repair. All water and lubricating oil pumps are built in with the main engine and direct or gear driven, which not only adds to the lines of the unit, but lends to smoother general performance of the auxiliaries. The engine is fitted with a closed cooling water system, utilizing river water for cooling and clear water used in the engine water jacket by passing the river water through the tubes of a Groco heat exchanger, and passing the clear water for the engine around these tubes in a similar fashion to a condenser in steam power plant. The lubricating oil for the main engine is handled by a gear type pump, which passes the oil through a Nugent pressure oil filter, and thence to a small Harrison heat exchanger for cooling by the clear engine jacket water. The circulating water pump on the engine for handling the clear water is of Sherwood gear type. The river water supply is handled by a centrifugal pump direct connected to the crankshaft of the engine. The Buda main engine is started by an electric starter motor of the 32-volt starter type. The starting and lighting batteries are kept charged by a 32-volt ¾ kw. generator which is gear driven. The power from the main Diesel engine is transmitted to the propeller through a clutch and reverse transmission and herringbone reduction gear of 2½ to 1 ratio, manufactured by the Auto Engine Works. The propeller on this boat is a three-blade left hand bronze type, 36″ diameter by 34″ pitch, and the stern bearing and shaft log bearing and stuffing gland are of the metallic type. Exhaust from the main engine is carried into a Maxim silencer located in the stack. An "Alnor" pyrometer is provided for supplying exhaust temperature readings from the main engine.

Fuel is carried in two Diesel oil tanks located in the hull immediately forward of the pilothouse, and which have a total capacity of 350 gallons. Lubricating oil is stored in a 50-gallon tank in the hull aft of the cabin. Electricity for lighting the boat and starting the main engine is supplied by a 32-volt Exide battery. Battery charges are maintained by the generator on the main engine. A bilge pump is located forward of the main engine in the machinery pit, and is of the spiral flow type, being driven by a 1 hp. electric motor, which receives its power from the main battery unit. Engine controls are located within easy reach of the pilot for controlling the speed of the engine and the forward and reverse of the clutch mechanism. The pilot-house wheel is of mahogany construction and of such size as to handle the rudders quite easily. This pilothouse wheel is connected by tiller cable to the forward and aft rudders which are of a balanced design and furnish excellent rudder power for the boat. Particular attention is invited to the small forward rudder which is located immediately forward of the propeller and between the propeller drive shaft tube and the hull. This rudder has proven quite effective when backing, and is so located as to catch practically no drift. An instrument panel is provided in the pilot house to show the various temperatures and pressures of the lubricating oil, circulating water, rate of charge of generator, and tachometer for showing the propeller revolutions, all of which are of Stewart-Warner manufacture. The engine room is provided with fire protection system of two Lux cylinders.

NEW POLISH MOTORSHIP

TRIESTE, April 14. — After three days of thorough testing for speed and efficiency of operation in the Adriatic, the new Polish twin-Diesel liner *Batory* was pronounced fit and ready for her maiden voyage from Gdynia to New York, May 17 to 26, by Captain Eustazy Borkowski and a technical commission of experts.

In her trial runs, the *Batory* attained a maximum speed of 20 knots with no discernible vibration and with faultless functioning of equipment. The commission of experts made particular note of the remarkably small amount of fuel oil needed on the high-speed runs. The two main Sulzer type Diesels develop 12,500 hp.

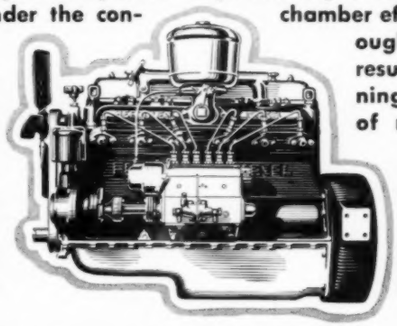
The *Batory* will proceed to Dubrownik, Jugoslavia, whence it will continue through the Mediterranean to Barcelona, Spain; from there, to Casablanca, Morocco, then to Madeira, Lisbon, through the English Channel to London, and finally to her home port of Gdynia, arriving on May 11.

She will have on board 650 passengers who came by special train from Poland to Trieste.

The *Batory* is the sister-ship of the *Pilsudski*, which entered the Atlantic service last September. The two ships will be in the service of the Gdynia America Line, on the New York-Halifax-Copenhagen-Gdynia run. At a normal speed of 18 knots, the New York-Copenhagen run is cut down to 8 days, and the Gdynia run to 8½ days. Like the *Pilsudski*, the *Batory* is 514 feet long, 72 feet beam, has a replacement of 16,000 tons and a capacity of 750 passengers.

HERCULES DIESEL ENGINES

STAMINA—The first requirement of every piece of heavy-duty equipment, whether it be a truck, a bus, a tractor or a power shovel, is *stamina*—ability to take punishment and stand up under the continuous stress of productive work. Above all, the engine supplying the power *must* be right—rugged in design, well built and easily serviced. Hercules Diesel Engines have all of the rugged *stamina* inherent in this type of power plant, plus clean, compact design and performance characteristics which are unusual and result from the Hercules exclusive, patented pre-combustion chamber. This chamber effects an unusually thorough mixture of fuel and air, resulting in a smooth-running, clean-burning engine of remarkable efficiency.



Hercules' experience in designing and building heavy-duty power plants is at the service of manufacturers of power-driven machinery.

HERCULES MOTORS CORPORATION, Canton, Ohio

America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H. P.

F. G. GURLEY TALKS ON *ZEPHYRS*

. . . . *Continued from page 39* . . . .

Assuming trained personnel, proper facilities, an adequate stock of repair parts, and including a spare power truck, or at least spare traction motors, it would seem that theoretically a Diesel-electric could be kept in road service constantly between general repairs. Removal of the crank shaft for grinding is the outstanding work which will necessitate general repairs. Experience will determine the mileage we can make before that is necessary. It should be over 500,000 miles. Of course as a practical matter no such perfect availability can be obtained, because something will happen to prevent it.

The increased availability and greater continuity of service of the Diesel-electric engine is one of the strongest arguments in favor of its use. It means less units are needed, and the cost of maintenance is materially influenced by the number of units as well as the mileage they make. The rapidity with which repairs are made, contributing as it does to greater availability, is also closely associated with maintenance costs. I stated previously that maintenance cost had certain speculative aspects but after studying it carefully we concluded that the maintenance cost of the Diesel-electrics, which I shall mention later, would about equal those of a corresponding steam engine with the probability that the Diesel-electric cost would be slightly lower.

Fuel costs: The high thermal efficiency of the Diesel is one of its outstanding characteristics. The saving in fuel costs produced by our switchers and *Zephyrs* has been given. A study of our proposed Twin City and Denver passenger runs developed that attractive fuel economies would be obtained with a Diesel-electric. It is possible however that in some locations the relative costs of coal and Diesel oil delivered to the engine will be such that a transportation service unit may be rendered by a steam engine with less fuel cost than with a Diesel. Generally speaking this will not be true. This merely means that no blanket rule can be laid down. Each situation must be analyzed. In so far as high speed passenger service is concerned the roads in our territory have favored burning oil on steam engines, apparently to avoid the delays I have mentioned. The steam locomotive company which submitted a proposal for our new Denver service recommended that we burn oil. I have never encountered a case where a Diesel did not produce an equal or greater amount of transportation service for substantially less fuel costs than a steam locomotive burning oil.

We plan to inaugurate 16-hour passenger service between Chicago and Denver, a distance of 1,034 miles with two 10-car trains. The route of passenger trains is somewhat longer than the one used on the non-stop run I mentioned previously. These two trains each have an assignment of 31,450 miles per month, or 377,410 miles per year. We shall also replace the two 3-car trains between Chicago and the Twin Cities with two 6-car trains because the present ones are not large enough. The equipment released will be transferred to places where we feel the improved and expedited service will build up patronage as it did between Chicago and the Twin Cities.

After evaluating all of the circumstances, some of which I have outlined, we decided upon Diesel-electric locomotives for these four larger trains. We will purchase four 1,800 hp. and two 1,200 hp. power units. An 1,800 hp. and a 1,200 hp. unit will be coupled together on each Denver train, thus furnishing 3,000 hp. and the 1,800 hp. units will be used on the Twin City trains. The 1,800 hp. engines will be interchangeable, thus providing flexibility.

The cylinders of all our Diesel engines in road service will be of the same size, as will all traction motors.

The spare truck planned for protection at Chicago will fit under the 1,800 as well as the 1,200 hp. units.

In summarizing we find that the first Diesel-electric high speed passenger train began operation 16 months ago. The first Diesel-electric sold to an American railroad 11 years ago cost $200 per horsepower. The present price is about $100 per horsepower. Steam locomotive construction costs after 100 years of development may have become stabilized because we find no corresponding decrease in their costs. There are reasons to believe that Diesel-electric costs may be further reduced.

The Diesel electrics have a high record of availability, and possess the advantages I have described. It is much too early to make definite statements but apparently the indications are that the number of Diesel-electrics in railroad service will increase. I say that because I cannot interpret the facts as warranting the prophecy made by some steam advocates concerning the lack of future for Diesel-electrics in rail transportation work.

This does not suggest the passing of the steam engine – far from it. The builders of conventional steam engines are alert, and today more than at any previous time are endeavoring to produce an engine that will make longer runs, give greater availability, and cost less to maintain than existing engines. In addition to that the designers of a new flash type high pressure steam engine are enthused about their prospects.

At the same time the companies making four-cycle Diesel engines, apparently in an effort to reduce the weight per horsepower, have been trying to get more power by supercharging, and report considerable success.

The prospects seem to be that railroad management will have more opportunities than ever before to select from the various types made possible by the genius of the American engineer and resources of the manufacturer the motive power best suited for different conditions. We should be thankful for this, and earnest in our efforts to meet our obligation by making the right selection.

EDITOR'S NOTE – The four-cycle Diesel engines mentioned by Mr. Gurley are Cummins. The two-cycle engines to which he refers were manufactured by the Winton Engine Corporation.

Safe Silencing!

With Model SC-2

MAXIM SPARK ARRESTOR SILENCER

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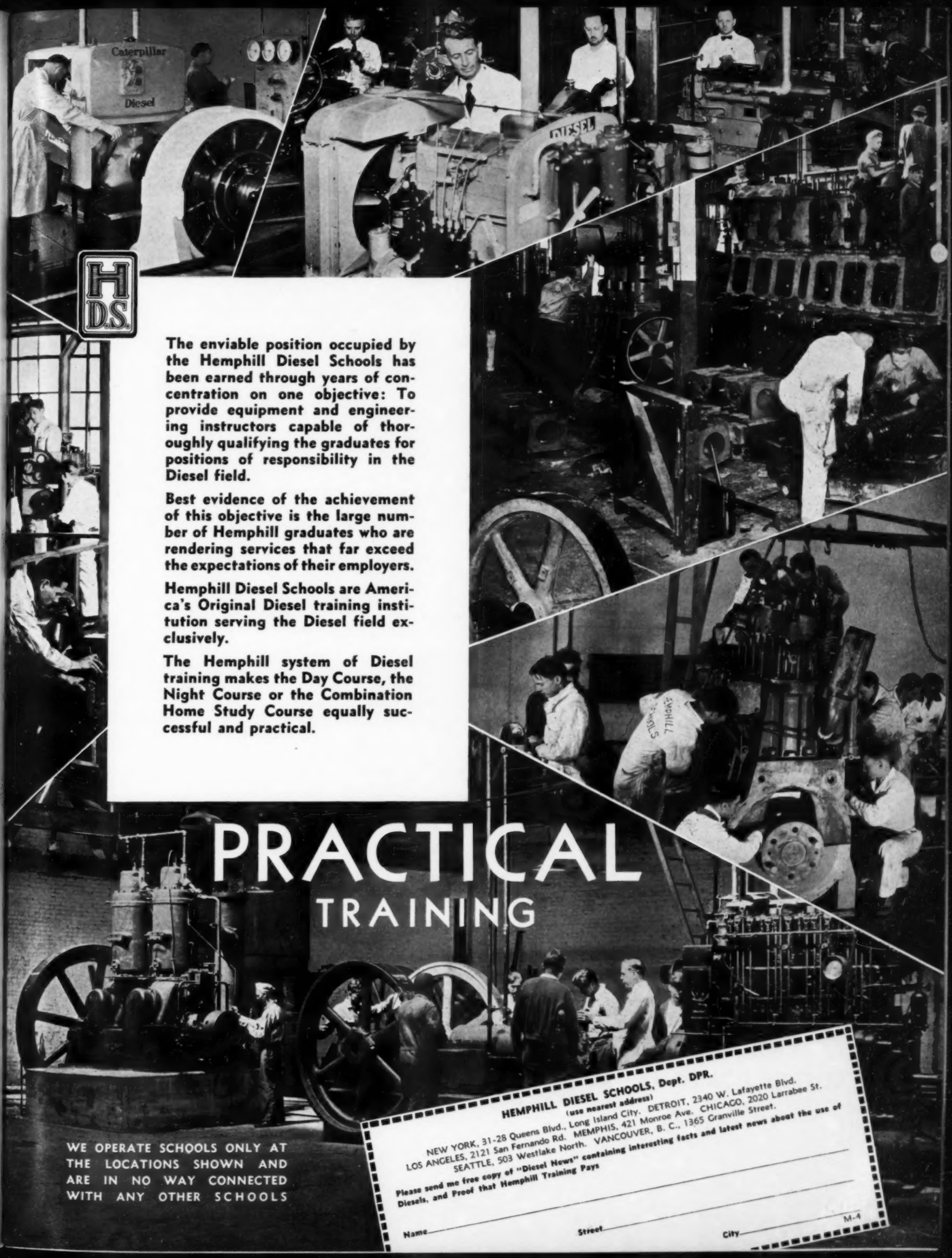

The enviable position occupied by the Hemphill Diesel Schools has been earned through years of concentration on one objective: To provide equipment and engineering instructors capable of thoroughly qualifying the graduates for positions of responsibility in the Diesel field.

Best evidence of the achievement of this objective is the large number of Hemphill graduates who are rendering services that far exceed the expectations of their employers.

Hemphill Diesel Schools are America's Original Diesel training institution serving the Diesel field exclusively.

The Hemphill system of Diesel training makes the Day Course, the Night Course or the Combination Home Study Course equally successful and practical.

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LOS ANGELES, 2121 San Fernando Rd. MEMPHIS, 421 Monroe Ave. CHICAGO, 2020 Larrabee St.
SEATTLE, 503 Westlake North. VANCOUVER, B. C., 1365 Granville Street.

Please send me free copy of "Diesel News" containing interesting facts and latest news about the use of Diesels, and Proof that Hemphill Training Pays

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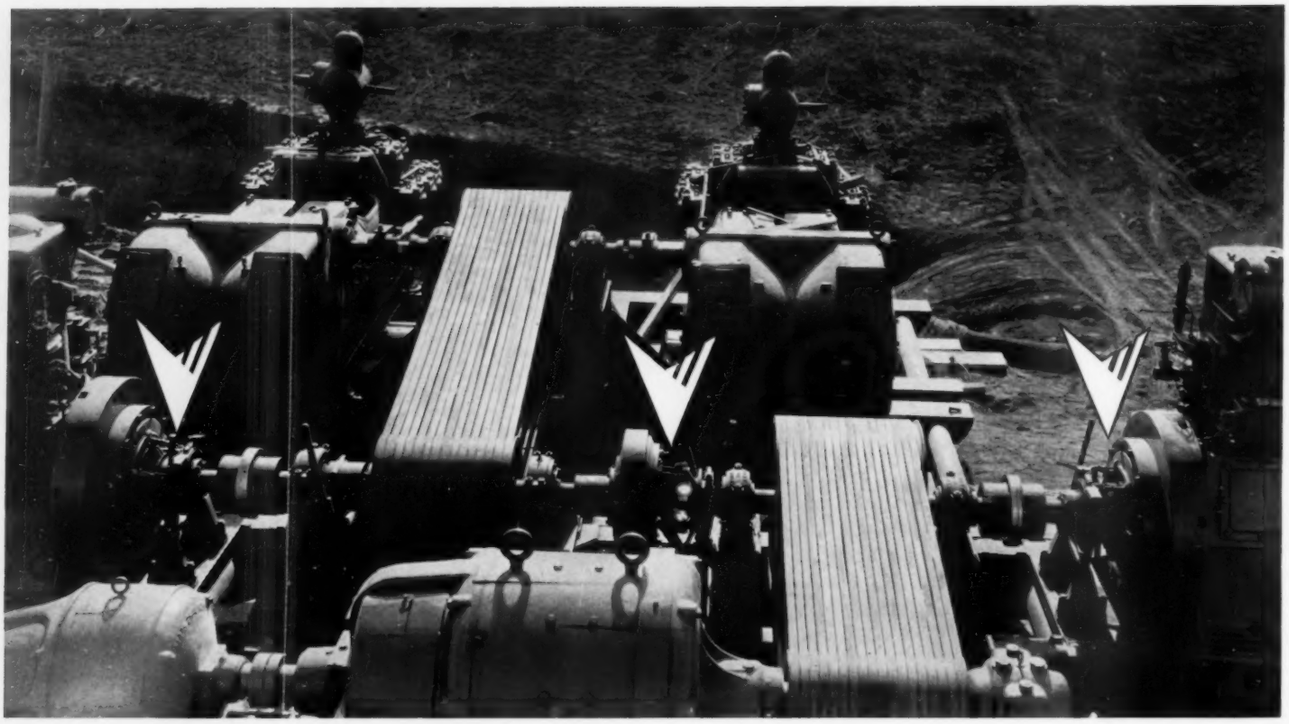

DUAL POWER ROTARY RIG OF SPRING ROSE DRILLING COMPANY

is

TWIN DISC EQUIPPED

Simple, flexible and efficient . . . the light rotary drilling rig assembled by the Spring Rose Drilling Company, Wichita, Kansas, has the draw works driven by electricity and the slush pumps directly from the engines. Each of the 220 hp., 9 in. x 10½ in., six cylinder *Atlas* Diesel Engines is equipped with a 7608, 2 plate, 24 in. Twin Disc Clutch; with a third clutch, an 8100-C.R., 2 plate, 24 in. Twin Disc, located in the line shaft between the two V-belt power take-offs. One of these transmissions is used to drive the generator, the other the slush pump drive shaft.

In oil field drilling it is performance that counts. To the experienced oil field operator the Twin Disc Clutch stands for greater reliability in continuous operation . . . with flexibility and power control. That's *why* regardless of who makes the engine, or who builds the rig, you will invariably find the Twin Disc Clutch standard equipment. It is significant that *more Twin Disc Clutches are in use in the oil fields than all other makes combined.*

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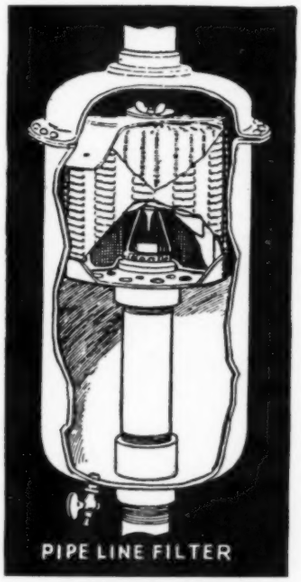
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CHIMAERA

. . . . *Continued from page 41* . . . .

ing economy; and, with Diesels in her engine room, a cruising range of a thousand miles or more is available if required. Since Mr. Archbold intends to make an extended trip up the Atlantic coast and thence along the St. Lawrence River this summer, this latter factor was undoubtedly a major consideration in his choice of power in addition to the well known Diesel safety and economy.

Two Superior engines are installed of six cylinders each. They are rated individually at 100 hp. at 1600 rpm. and drive the twin propellers through Joe's reduction gears with a ratio of two to one. The engine room is readily assessible through a door from the galley and hatches in the deck house floor provide ample room for periodic overhauls. Despite the quiet operation of the engines, the customary Elco rubber mounting and insulation is installed thus insuring a three-way guarantee against objectionable noise. The Diesels on the *Chimaera* are fresh water cooled and her speed is predicted to be between 15 and 16 mph. Both engines are protected by Purolator fuel oil filters and Cuno lubricating oil filters.

Deck arrangement is more or less conventional with plenty of space for lounging or fishing chairs in the stern and a spacious fore deck for handling ground tackle and for the crew when off duty.

The raised bow slopes gracefully aft to give ample freeboard in the form of bulwarks above deck level. These provide easy passage fore and aft and also permit the use of considerably larger after cabin ports than otherwise would be practical. This sunken deck effect gives in addition an unusual feeling of comfort and security as well as improving the boat's external appearance by reducing the height of visible cabin above deck level.

The interior arrangements of the *Chimaera* are somewhat different from the usual Elco cruiser of this size. The crew's quarters and galley are placed completely aft thus providing ample space for the owner's double stateroom and toilet up forward. The customary single staterooms, one on each side of the center passage, have been replaced by a spacious main cabin containing a folding table and sleeping accommodations for four of the owner's party, one berth being made up on each of the side cushions and one on each of the hinged back cushions which become upper berths. Counting two more in the upper lounging saloon gives *Chimaera* a total sleeping capacity of eight plus one in the crew. The strength bulkheads separating these various compartments contribute very materially to the previously mentioned seaworthiness of this trim craft and make her practically unsinkable. Below decks throughout the *Chimaera* one is constantly impressed by the clever utilization of every available inch of space without the suggestion of crowding. Unusual headroom and plain surface joiner work heighten the effect of roominess so desirable at sea.

All in all, the *Chimaera* is as complete and trim a yacht for her size as will see blue water this season and it is altogether fitting that she should have two of the latest model, light weight, high speed Diesels to match her up-to-the-minute design and construction. The cost of fuel oil compared with equivalent operation with gasoline will be approximately one-quarter. Danger from fire or explosion of gasoline vapor is automatically eliminated and her cruising range without refueling is approximately doubled. With the above advantages coupled with the thorough dependability of today's Diesels it is little wonder that the answer to "What boat is that?" is more and more frequently, "The Diesel yacht ——!"

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BECAUSE they will produce 99 8/10% clean oil.

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FIG. 1116 NC #1R

THE 127 H.P. 6 CYLINDER BUDA DIESEL ENGINE IN THIS BOAT IS PROTECTED BY NUGENT PATENTED PRESSURE FUEL AND LUBRICATING OIL FILTERS, SIZES 0 AND 1R, RESPECTIVELY.

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TRACTRACTOR

Above: Part of the A. C. Ochs company's clay pit from which the overburden is being stripped by the International Diesel TracTracTor and wagon scraper shown here. The TracTracTor loads the scraper, pulling in second or third gear and taking a 5 to 6-foot cut. Due to the nature of the material, a 3½ to 4-yard load is picked up in a 60 to 100-foot run. When the operator has the desired load, he travels in fourth or fifth gear to the point of dumping.

The end of the load. The operator quickly swings the TracTracTor and scraper around, backs up, and dumps the load. The TracTracTor can back the scraper clear over the edge of the fill in dumping the dirt so that no bulldozing or scraping is necessary.

ANOTHER record for effecting great savings on a tough job is credited to the International Harvester Diesel TracTracTor in its work of stripping the unusually stubborn hard-pan overburden in the clay pit of the A. C. Ochs Brick & Tile Co., Springfield, Minn.

Stripping this overburden has always been a problem. Before buying the International Diesel and a wagon scraper, the Ochs company tried various methods. Horses and scrapers were employed originally, and were followed by different types of drag lines, steam shovels, etc. The last contract job, using a powered drag line, was let at 16 cents a cubic yard. However, the work proved so difficult that many contractors were forced to withdraw because their equipment couldn't stand the punishment.

When the International Diesel TracTracTor and scraper wagon went to work, it was obvious from the start that large savings were going to be made. The figures show that the per-yard cost of fuel, lubricating oil, and operator's wages add up to 2 cents . . . interest, depreciation, and other items are conservatively estimated at 3 cents . . . making a total of 5 cents a yard—*a saving of more than two-thirds over the previous method!*

You can learn more about International Diesel Power, available in the TracTracTor and as a Power Unit, by calling on the nearest Company-owned branch or industrial power dealer . . . or write to us.

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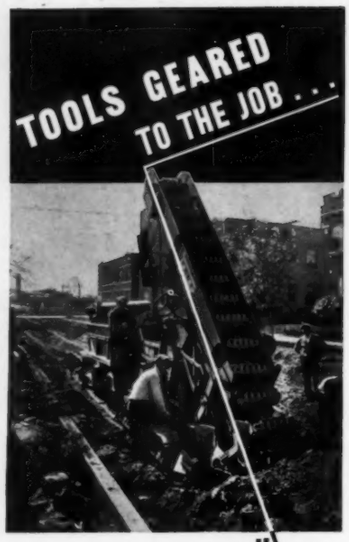

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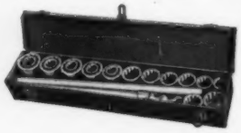

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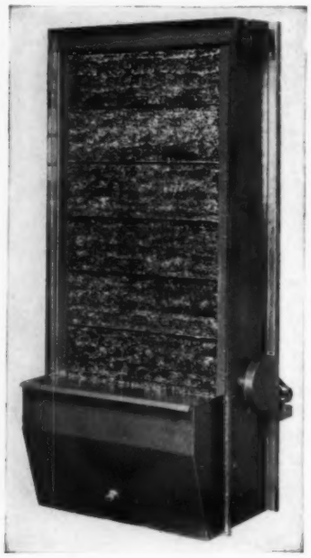
THE Staynew Filter Company have recently announced a new automatic impingement type air filter. This filter while adhering to the well known principle of oil impingement, differs considerably in design, from past and present types. The principle of the design is the provision of four successive stages of filtration in the form of two endless curtains arranged to rotate in such a manner that the face of the curtain on the dirty air side will be thoroughly cleaned before returning to the clean air side. The first stage collects the heavier part of the dust, serves to break up the air flow into innumerable small streams, thus causing it to assume more intimate contacts with the adhesive surface. It then proceeds downward into the oil bath, where the surface tension of the oil film is released, thus allowing the dust particles to settle by gravity to the bottom of the reservoir. In its passage through the oil, all parts of the media will be immersed for approximately 1½ hours.



Leaving the oil bath, the first stage becomes the second stage after passing a compressed air line consisting of copper piping with a line of small holes drilled therein, from which air is blown through the medium to remove any unnecessary oil surplus. It then moves upwards in its oily-saturated state to entrap any finer particles of dust that may be left in the air stream.

The third stage serves to collect any residue of oil that may have a tendency to entrain in the air stream after passing through the first and second stages and also serves to entrap the finest dust particles that may remain. This stage proceeds downward into the reservoir, but does not pass through the oil bath, clean-

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D. P. 9

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CORRECT LUBRICATION

ing being accomplished by a second air line similar to the first. After passing over this, it becomes the fourth stage, which acts as a preventative to further oil entrainment and as the final stage in the removal of the fine dust particles.

The third and fourth stages therefore operate in a comparatively dry state, since they serve to further the efficiency of the filter in general by arresting both oil and dust that may have escaped the first two stages.

Capacities in C.F.M. are based upon an air velocity of 500 F.P.M. through the third and fourth stages, but velocities through the first and second stages will only average between 450 and 475 F.P.M., thus making allowance for the heavy dust concentration on the two first stages, so that the resistance will remain constant throughout.

The framework is rugged and well-braced, arc-welding is used throughout, and all parts are proportioned with a view to the filter withstanding any severe handling in shipment or in service. Solid cold-rolled steel shafts are provided at both top and bottom to retain and carry the filter medium, the shafts rotating in ball bearings housed in semi-steel castings. End-plates are made of No. 10 gauge U.S.S. sheet steel and secured at top and bottom with angles, welded into place and all drilled for duct connections. Further bracing of the framework is achieved by the use of gusset plates at the bottom and the air seal plates at the top. The reservoir is provided with drain plug and sludge pan, and to the latter is attached a permanent one-piece handle, thus making it convenient to use in disposing of the sludge. Sideplates are strongly reinforced by the screen guides and air seals attached thereto within the framework. Compressed air lines consist of all copper "Streamline" piping, to insure against any form of corrosion.

The filter curtain consists of panels of wire cloth to which are attached successive layers of knitted copper mesh. These panels are attached in turn to an endless curtain of wire cloth, which is reinforced with cold-rolled steel square rods, to prevent any possibility of buckling when air is passing through. The ends of the horizontal rods are secured to ⅜ in. pitch roller chain, which passes over sprockets attached to shafts and insures a positive movement. The filter panels are easily removable. A small screw driver is the only tool necessary to perform this function.

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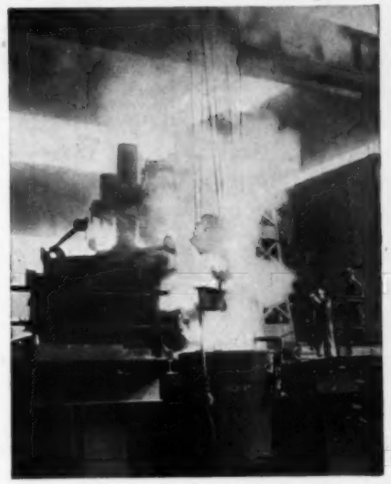

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DIESELS IMPROVE *DORETA*

. . . . *Continued from page 25* . . . .

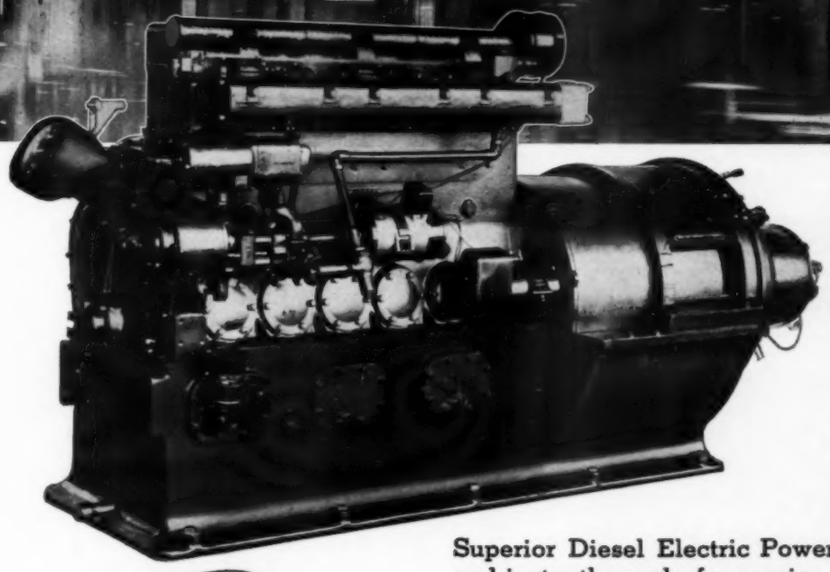
than words the strikingly unusual interior decorations and furnishings executed by Miss Helen Novak of New York City. *Doreta's* crew consists of captain, two sailors and one steward comfortably quartered forward. She is fitted with two separate lighting plants, electric heating and refrigeration, a Lux fire extinguishing system, Shipmate stove, a Chris Craft runabout and complete ground tackle and customary gear.

No change was made in the existing 800-gallon copper fuel tanks carried amidships although care must be taken to see that the fuel oil is drained when the vessel is laid up for any length of time. The copper exhaust pipes were replaced with rubber which is impervious to the Diesel exhaust gases. Robert Jacobs, previously mentioned, deserves due credit for the excellent job of insulating the engine room. In fact, there is considerably less noise now than before the conversion. The exhaust is clear and clean giving no offensive odor and vibration is completely nil despite the fact that no special engine mounting was installed.

Mr. Wheeler is to be congratulated upon such a satisfactory solution to his problem and the *Doreta* as she now stands is a shining example to thousands of yachtsmen of what a little thought and Diesel engines can do toward increasing yachting pleasure and decreasing yachting expense. When questioned concerning the conversion, Mr. Wheeler stated:

"I am very well satisfied with the motors and the installation and I think they are equal if not superior to the gas jobs in performance, and certainly much better on economy. Taking it all in all I am delighted that I made the change, and in my opinion Diesel motors in the next few years will be the only equipment in boats of over 50′ size."

Such a statement from so ardent a yachtsman who is testing his first Diesels after years of gasoline cruising certainly seems to indicate that the Diesels are exceeding expectations as usual. Doubtless the most interesting feature of *Doreta's* conversion next to fuel economy is the fact that the new engines fitted the existing engineroom with space to spare. It is important to the owners of gasoline yachts to note that they can change to Diesel without disrupting their present interior plan or accommodations. To all yachtsmen, whether ordering a new boat or conditioning an existing vessel, the subject of Diesels is increasingly important. Diesel advantages cannot be denied.



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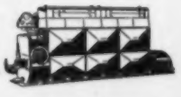

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THE illustration shows units built by the Young Radiator Co. to handle cooling problems on various types of Diesel engines. A comparatively light weight, highly efficient heat exchanger is used for cooling the engine oil on high speed streamlined trains. This unit is especially desirable where space is limited and weight is an important factor. The companion unit, also shown, cools the jacket water for the same installation. It is ruggedly built to withstand the rigors of rail travel with heavy header sheets and cast end tanks and has a fin and tube surface of extremely large cooling capacity. Radiators for cooling smaller Diesel engines on power units are also manufactured by Young. These are built with heavy cast tanks and side members and designed to withstand the hardest kind of service.

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FOR 36 YEARS

DIESEL

28 MODELS
5 to 120 H.P.

GENERAL OFFICES
LANSING, MICHIGAN

11 BROADWAY
NEW YORK, N.Y.

565 W. WASHINGTON BLVD.
CHICAGO, ILLINOIS

TATEKAWA MARU, JAPANESE DIESEL TANKER

THIS Japanese motor tanker which has been in active service since June 30, 1935, is propelled by the highest powered Japanese M.A.N. double action, two stroke Diesel engine ever built and is herself one of the highest powered single screw motor ships in existence. Following is a table of principle dimensions and capacities:

Length o.a.	524.1 feet
Length b.p.	499.8 feet
Beam moulded	64.9 feet
Depth moulded	37.1 feet
Draft l.w.l.	29.5 feet
Deadweight	13,691 tons
Cargo (heavy oil)	14,599 cu. meters
Cargo (special oil)	277 cu. meters
Cargo (general)	2,288 cu. meters
Cargo (silk)	333 cu. meters
Gross register	10,152 tons
Speed (trials)	20.5 knots
Engine output	9,000 b.h.p.
Corresponding rpm.	125

Extending to the upper deck, the oil cargo holds are divided by two continuous longitudinal bulkheads and by transverse bulkheads into six tanks on both port and starboard and five center tanks making a total of seventeen in all. These are separated by cofferdams and an oval shaped tank for special oil is built in forward.

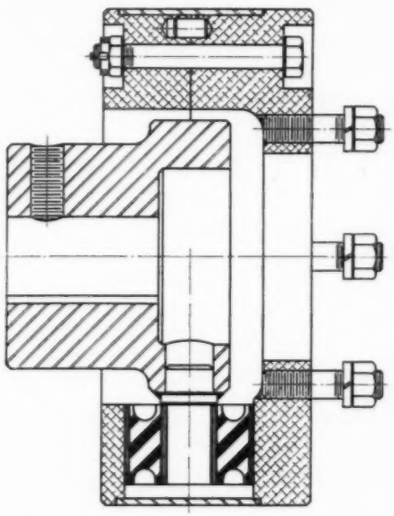
The pump room is placed amidships and contains four cargo oil pumps with a capacity of 300 cubic meters per hour each at a pressure equivalent to a head of 100 meters of water. The following Worthington type equipment is also in this pump room: A petrol pump with a capacity of 40 cubic meters per hour against a head of 35 meters of water, a bilge pump of similar size, an 80 ton bilge and ballast pump and a Sirocco ventilating fan of 200 cubic meters capacity.

The main Diesel propelling engine has eight cylinders with a 700 mm. bore and 1,200 mm. stroke and conforms to the standard M.A.N. design under which license it was manufactured at Kawasaki.

In normal service and at her designed speed the *Tatekawa Maru* uses thirty-seven tons of Diesel fuel for each twenty-four hour day's operation. Since the equivalent fuel oil required to drive such a vessel if steam-powered would be 100 tons a sixty-three per cent saving is effected.

NEW YORK CENTRAL ORDERS SEVEN DIESEL SWITCHING LOCOMOTIVES.

ON Friday, April 10, the Electro-Motive Corporation received from the New York Central Railroad an order for seven new Diesel locomotives to be placed in switching service. These will be 100 ton units carrying 600 driving and 65 auxiliary horsepower. They will have a maximum speed of 35 mph. and a starting tractive effort of 60,000 lbs. at 30 per cent adhesion. Power will be furnished by 8 cylinder, 2 cycle Winton Diesels, one engine for each locomotive.



NEW rubber-cushioned propeller shaft coupling dampens vibration. Introduction of the Morse Radial Morflex Coupling, a new and improved flexible coupling for marine propeller shafts, caught the marine industry at a particularly opportune time. Rubber engine mountings had already proven themselves as a means of lessening engine vibration, and the addition of the new Morse Radial Morflex Coupling was another important step in this direction.

The Morse Radial Morflex Coupling transmits power to the propeller shaft without shock or vibration. It replaces the conventional universal joint or flexible coupling.

The torque is transmitted by a flange on the engine or reduction gear to the rubber trunnions, and through them to the propeller shaft. The Morse Radial Morflex Coupling is fully enclosed, requires no lubrication, has no back lash and, therefore, develops no noise. It permits slight misalignment and has been thoroughly tested under the most severe operating conditions.

FOR NEW AND REPLACEMENT NEEDS

dependable R.P.M. INDICATION WITH

WESTON ELECTRICAL TACHOMETERS

No matter what your requirements in speed indication, the solution is simple when electrical indication is installed. It means merely mounting a Weston Generator and Indicator and running connecting wires. If indicators are desired at remote points, they are readily wired to the one magneto generator.

Electrical Indication has other advantages, too. Accurate indications are assured at all times for the Weston Tachometer follows all speed fluctuations instantly and smoothly. And their operation is practically free from all maintenance worries and expense. Let us send you complete details . . . Weston Electrical Instrument Corporation, 579 Frelinghuysen Ave., Newark, N. J.

WESTON *Instruments*

HOW TO BE SURE

UNLESS the air filter you apply has an exact density, that cannot be shaken out of position by intake impulses or vibrations, you cannot be sure of adequate protection.

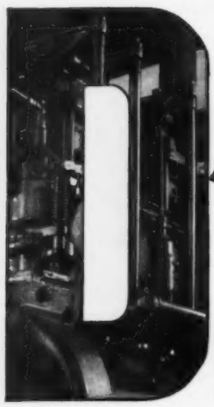
In the Oil Bath Type Air-Maze the density is built-in and both the air and filter element are automatically washed with oil. All joints are gasket sealed and at no point through careless service handlers can its efficiency be disturbed.

More than 120 manufacturers of industrial equipment use Air-Maze as original factory equipment, including all air compressor builders to which low restriction with high efficiency is the first consideration.

Write for Bulletin IND95A

AIR-MAZE CORPORATION
814 HURON ROAD CLEVELAND, OHIO

AIR-MAZE
INDUSTRIAL AIR FILTERS



DIESEL ENGINEERING

--- a new field of opportunity for ambitious men

● THE man who ignores the significance of Diesel training in these modern times deliberately ignores his own future. This is especially true of men who work in industrial power and lighting plants; in small community power and light plants; in municipal pumping stations for water supply; in construction work, including trucks, tractors, hoists, graders and power shovels; in transportation, with special reference to buses, rail buses, locomotives; in marine service, including ocean liners, freighters, river and lake vessels, yachts and small cabin cruisers.

Right now, while the thought is in your mind, mail the coupon below for complete information on the I.C.S. Course on Diesels, the first step taken by many leaders in the Diesel field today.

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 8068, Scranton, Penna.

Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject *before* which I have marked X:

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If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada.

COLD STORAGE WAREHOUSE

. . . . *Continued from page 43* . . . .

ments. Both engines are protected by Purolator lubricating oil filters.

The five-story and basement plant with 18 rooms, containing half a million cubic feet, requires 130 tons of refrigeration at capacity. The storage of meat, fruit and vegetables delivered from nearby Wallabout Market calls for temperatures ranging from 34 degrees above zero to 5 degrees below zero. Each room is inspected hourly when the thermometers are read and adjustments of temperature are made.

The Hall Street Cold Storage Company take pride in the fact that they have provided shippers and buyers such splendid storage facilities – that their power economy program has been so successful.

The operation of the old electric motors cost them 2½c per kwh.– a high rate when you consider that the same work is being done with Diesels at ¾c per kwh. Their purchased power bills used to be $10,000 yearly – the cost of Diesel operation is $4,000 yearly – the savings amount to $6,000 yearly – increasing as the investment for the engines is retired. At this rate the two 140 hp. engines installed in the Spring of 1934 will pay for themselves in less than three years, or by January, 1937.

The plant is a Mecca for everyone interested in power economy – the reduction of power expense. It affords those interested in this vital part of business an opportunity to judge for themselves as to the practicability of lower refrigerating power costs with modern Diesels.

LONDON LETTER

. . . . . *Continued from page 28* . . . .

the Acro combustion system in conjunction with push-rod operated overhead valves and a C.A.V.-Bosch pintle type self-cleaning injector. The engine is mounted on a sub-frame with the clutch and gearbox, the latter providing three forward ratios with synchromesh engagement for top and second.

Owing to the tractor's light weight and the large bearing surface afforded by the rubber tracks, the ground pressure is only 6 lbs. per sq. inch – less than a man walking – and this allows it to operate over wet turf without causing any damage to the grass. The machine can travel at speeds of from 2 to 14 mph., averaging about 25 mpg., and can haul a quintuple gang mower or rollers with the greatest of ease.

Seven Good Reasons for Using BURGESS Exhaust Mufflers

Seven superior construction features distinguish the HDF series of Burgess exhaust mufflers, the most modern and efficient mufflers for railroad, marine, industrial, and automotive Diesels.

1 ***Straight-through*** **construction offers no more back-pressure than an equal length of the same diameter pipe!**

2 ***Silences effectively*** **the entire range of exhaust noise frequencies without changing direction of gas flow!**

3 ***Absorption and suppression*** **chambers —the only industrial muffler which utilizes both methods of exhaust silencing.**

4 ***Compact*****—mounts in any position. The length approximately equals nine times the core diameter.**

5 ***Removable core*** **and absorption chambers permit inspection and cleaning in case of excessive carbon residue.**

6 ***Fire-proof absorbent*****—the perforated metal absorbent chambers contain processed clay fired at 2000°F.**

7 ***American standard flanges*****—easily replaceable bolts and heavy gauge metal are important Burgess muffler features.**

Burgess exhaust mufflers contribute to the efficient operation of Diesel engines due to low back-pressure. They occupy little space and achieve amazing quiet from noisy exhausts.

Send for data and prices

Burgess Battery Co., Acoustic Div.
1025 E. Washington Ave.
Madison, Wis.

BURGESS ACOUSTIC

AIR CLEANERS AND SILENCERS BREATHER CAPS MUFFLERS ENGINE HOODS CAB TREATMENT AND ACOUSTIC DUCT LINING

LICENSED UNDER C. F. BURGESS LABORATORIES, INC., PATENTS

NEW DIESEL INSURANCE RATES

NEW coverage and rates for insurance on Diesel engines, in many cases representing substantial reductions from rates previously in effect, have been announced by the Boiler and Machinery Department of the National Bureau of Casualty and Surety Underwriters.

With the greatly widening field of usefulness of the Diesel engine, it became apparent that all users should become better acquainted with approved methods of installation and operation. With this end in view, the insurance companies, acting through the National Bureau of Casualty and Surety Underwriters, entered into discussions with the Diesel Engine Manufacturers' Association from which has resulted the following resolution:

WHEREAS, The Diesel Engine Manufacturers' Association has for some time been cooperating with the Casualty Insurance Companies in the development of an underwriting program contemplated to produce rates and coverage which appear to be appropriate for the insurance of internal combustion engines, it is therefore

RESOLVED, That the proposed plan of insurance provides adequate coverage at rates which appear properly to reflect the various conditions confronting us; and that cooperation between the Association and Insurance Companies will be continued with the idea of accumulating more complete experience and developing such modifications in the plan as may seem desirable from time to time.

The plan of rating inaugurated by the insurance companies contemplates rate differentials for the following four classes of Diesel engines:

Class 1. Engines manufactured in 1925 or later and provided with a Closed Cooling System.
Class 2. Engines manufactured prior to 1925 and provided with a Closed Cooling System.
Class 3. Engines manufactured in 1925 or later and provided with an Open Cooling System.
Class 4. Engines manufactured prior to 1925 and provided with an Open Cooling System.

Under the new plan, the rates for Class 1 engines are, for the most part, considerably lower than under the old plan, although the changed basis of rating, from cylinder number and size to horse-power capacity, prevents definite comparison except in individual cases. For the other three classes, rates may be either higher or lower than previously, but the general trend is to produce lower rates for Class 2, higher rates for Class 4 and very little change for Class 3.

DIESEL PROGRESS

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The Power Unit of the workboat U.S. PHILLIPS is equipped with

"The CAPITOL"

REVERSE GEAR

and

MULTIPLE DISC CLUTCH

100% Reverse Ratio

Full anti-friction bearing construction. High Reverse Gear efficiency. Alloy steel, heat treated parts with great strength and light weight. Patented exclusive design features.

"The CAPITOL" HERRINGBONE REDUCTION GEARS

are also offered in sizes 80 H.P. to 800 H.P.

They are extremely quiet in operation and have a water-jacketed housing.

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Manufacturers of "Capitol" MARINE ENGINES

Cable Address "Capmarine"

349 N. HAMLINE AVE. ST. PAUL, MINN.

"Many Years' Experience in Every Service"

NEW SANTA FE TRAIN

THE Edward G. Budd Manufacturing Company has announced receipt of an order from the Atchison, Topeka & Santa Fe Railway for an eight-car, light-weight, stainless steel train that will cut fourteen hours off the present running time between Chicago and Los Angeles. Due to the stainless steel construction, it will weigh only about half as much as a comparable conventional train, yet the safety factor will be increased, the announcement said.

The new train, which will be drawn by a Diesel electric locomotive, will operate between Chicago and Los Angeles on a once-a-week round trip. It will cover the 2,225 miles between the two cities in 39 hours, 45 minutes, compared with the present schedule of 53 hours, 45 minutes for the Santa Fe Chief.

ALL WINTON DIESELS IN ALL BURLINGTON "ZEPHYRS" USE DELCO BU-NITE PISTONS

The Winton Diesels that powered the original Burlington "Zephyr"—America's first Diesel powered streamline train—in 1934, was equipped with Bu-Nite pistons, as are the Winton engines in each of the newer "Zephyrs." Hundreds of thousands of miles traveled by these famous trains have confirmed the wisdom of Winton's choice of piston equipment. Although the load service required is double that normally carried by pistons in a four-cycle engine, these 8-inch by 11¼-inch Bu-Nite nickel-alloy pistons weigh less than 24 pounds each—a most important factor in the smooth operation and flexibility of this Winton power plant.

• • DELCO-REMY CORPORATION, ANDERSON, INDIANA, U. S. A. • •

It's a sweet-running generator

ELLIOTT GENERATORS *for* DIESELS

SURE IT IS. Elliott built that sort of performance into it. How? By correct design in every small detail—by the use of substantial, heavy, conservative construction—and by engineering the generator exactly to the Diesel which drives it.

So the operator reports "It's a sweet-running generator," having learned from experience that his Elliott unit will not let him down, that it will deliver the kilowatts smoothly, quietly, and vibrationlessly.

ELLIOTT GENERATORS are built in all sizes for direct or alternating current, and with exciters applied exactly as conditions require. When you are interested in Diesel engine generators be sure to talk it over with the Elliott Company man. In the meantime, write for descriptive bulletins and copy of the discussion "The marks of quality in Engine Type Synchronous Machines."

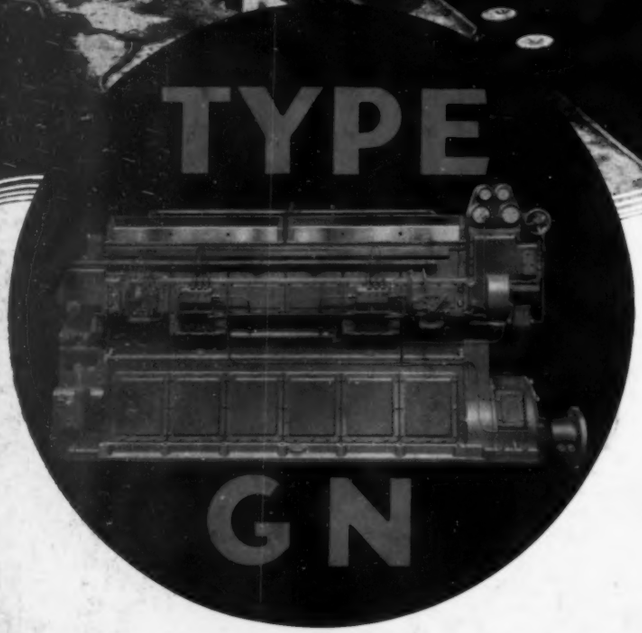
ELLIOTT COMPANY PITTSBURGH, PENNSYLVANIA

Electric Power Dept., RIDGWAY, PA.

J-650

District Offices in Principal Cities

A GOOD DIESEL FOR TUG BOATS



EVERYONE says that Cooper-Bessemer Type GN is a good looking Diesel engine — completely enclosed yet accessible. But it takes more than "looks" for any Diesel to get a job on one of New York State's tug boats. ¶ Reliability comes first. These state tug boat engines must be able "to take it" every day. ¶ Low cost operation comes next. No high repair bills or fuel and lube oil bills will be tolerated here. ¶ The engineers who chose the Type GN for the "Queen City" illustrated above based their decision on their experience with a whole line of Cooper-Bessemer equipped New York State Diesel tugs.

THE COOPER-BESSEMER CORPORATION

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